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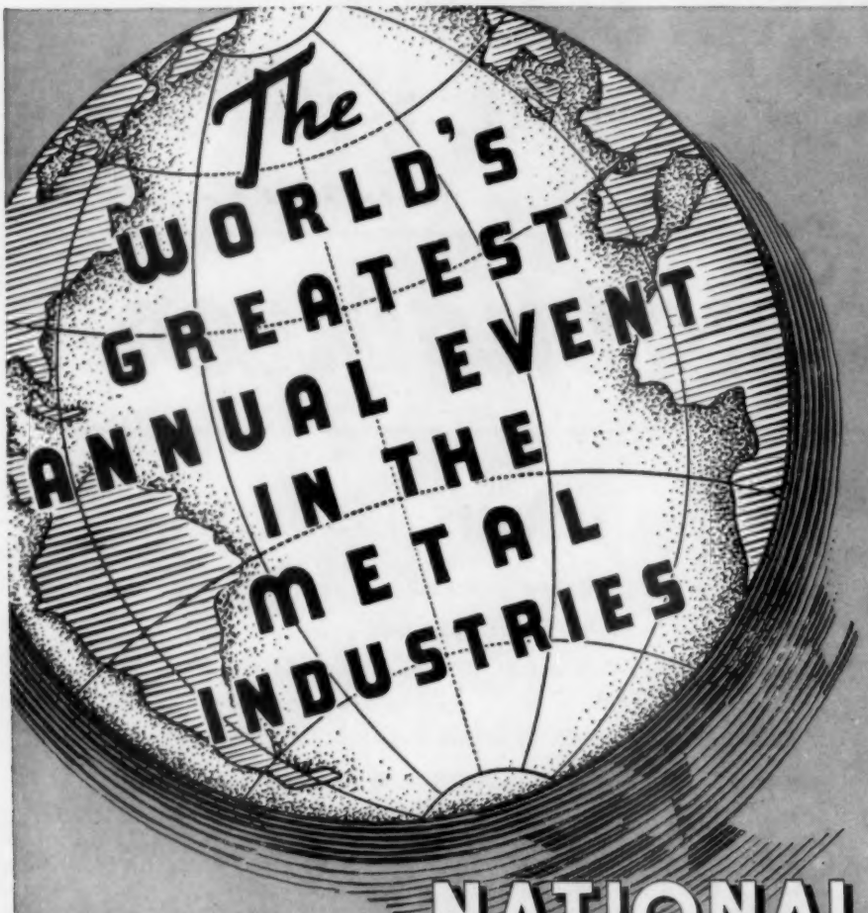

NATIONAL METAL CONGRESS ⇨ ⇨ ⇨

DECIDE NOW to join the thousands of metal men, members of five great technical societies, who will assemble in Detroit, between Oct. 17th and Oct. 21st, to bring themselves abreast of every latest development and new improvement in each phase of the Metal Industries. You will return to your desk inspired with new energy, new determination and new values to yourself and your company.

Co-operating to make the twentieth Annual National Metal Congress and Exposition surpass all previous meetings are:: American Society for Metals:: Wire Association:: Institute of Metals Division and Iron & Steel Division of A. I. M. M. E.:: American Welding Society.

OCTOBER 17 - 21
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DETROIT

NATIONAL METAL EXPOSITION

The Voice of Experience

THE VOICE OF experience beckons us to Peoria, Ill., well known as the home of the nation's largest distilleries. Peoria, Ill., however has another claim to distinction. It is the home of the R. G. LeTourneau Company, rapidly growing manufacturer of welded earth-moving equipment. Last year the business of this company passed the $5,000,000 mark.

We learn from a recent biographical sketch, under the title, "A Story of Faith That Led to Fortune," that Bob LeTourneau, president of the company, uses welding as a thinking tool as well as a manufacturing and construction tool. It simplifies the job of invention and provides him with more engineering freedom to develop designs which are vastly improved over existing designs. With the help of welding, Bob LeTourneau finds answers to problems which stump too many men in his position. In other words, welding has become a deeply ingrained faith largely responsible for his successful business.

When Bob LeTourneau first got into the business of making earth-moving equipment about 15 years ago out in Stockton, Calif., he had one objective in mind. He was determined to build better equipment than was then on the market. From his many years of automotive repair shop experience, he was convinced that welding was the tool which would enable him to "make a better mouse trap than his competitors." It is said that Bob LeTourneau never encountered a problem which he could not solve by welding.

"Many designers are handicapped," says Mr. LeTourneau, "because they have always thought in terms of castings. When they re-design to get the better strength and uniformity of rolled steel, they try to convert the old casting into a welded design. The most effective approach is to forget all about former methods. Think about the function of the machine or the part to be designed and use welded steel to produce the result. Whether he realizes it or not, the average man is governed by the dictation of years of habit. To be successful with welding, he should think in terms of welding, and follow the rules of welding, just as the casting man thinks in terms of casting and follows the rules of casting. The methods (and the results) of the one are in no way related to the other."

Mr. LeTourneau says further: "To exploit successfully the far-reaching advantages of welded steel construction, the manufacturer should have in his organization a man of authority with a zest for using welding. With such a man in the organization progress will be rapid as the fundamentals of welded design and production procedure are mastered." We believe all of our readers will agree with Bob LeTourneau.

Steer Away From Prejudices

WE RECENTLY CALLED on quite a number of welding repair shops to find out what type of work they were doing, how they were doing it, and what promotional efforts they were using. One thing stands out rather prominently as a result of these contacts. Too many men of long experience in the repair business appear to be dominated by decided prejudices on the relative merits of competitive welding processes. It is certain that they cannot all be right, because they are not in agreement. If you question such men for further information, some of them become sarcastic in referring to a process they are not using.

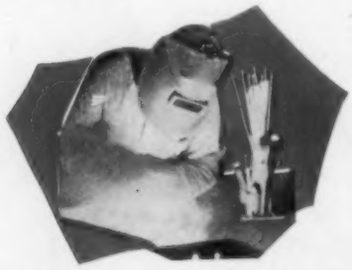
When a man stops learning in a rapidly growing field, such as welding, feeling that he knows all that he needs to know, that man apparently assumes that technical progress in the industry also stops. This is where he makes his mistake. Probably in no other field has engineering development gone ahead faster than in welding. Yet, we regret to admit, many practical men seem to be guided by prejudices established many years ago when welding was not as far advanced as it is today. Anyone who cares to dig into this subject, can ask some of the "old timers" of his acquaintance the best method of welding cast-iron. We are ready to bet last year's straw hat that such questioning will bring out plenty of prejudiced opinions.

We gather from the abundance of reliable literature on the subject of welding cast-iron, that several processes have merit and each one of them is especially suited to a specific welding problem. Any reader can verify this by checking the articles in THE WELDING ENCYCLOPEDIA, 9th Edition, and the A. W. S. Welding Handbook, 1938 Edition. We have enough good technical literature to enable anyone in the welding industry to keep abreast of technical progress. There is hardly any excuse for allowing prejudices to govern welding procedure. Those who have had the benefit of engineering training, know that to do so, would be running counter to the very basis of all engineering effort.

Without . . . and With

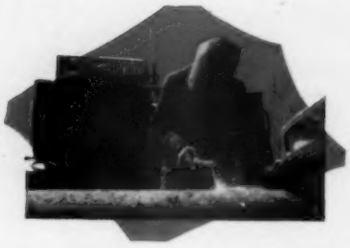
The new "Spatter Film"

These two specimens show how Lincoln "Spatter Film" reduces the tendency of spatter to stick to the plate, cutting weld cleaning time 20% to 50%. Just brush it on the joint. After welding, remove it with a clean cloth saturated with water. It contains no free alkali to harm paint. See how "Spatter Film" will cut your costs. Mail the coupon for Bul. 516.



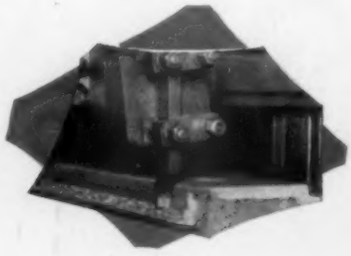
How one company saves $600 annually

With welding electrodes, it's cost per pound *deposited* that counts. Cost per pound *purchased* is only a small part of the story . . . One manufacturer found by actual test that "Fleetweld" saves him 6c per pound of deposited metal. Depositing 10,000 lbs., they save $600 per year. Get Bul. 401.



Cuts fuel costs 40¢ per hour

This new simplified Diesel *"Shield-Arc"* uses only 1.5 gal. of fuel oil per hr. as compared to 2.75 gal. of gasoline for the conventional engine driven welder. Savings in fuel costs are 33% to 86%. Ask for Bul. 327.



Now—machinable welds for cast iron

The new Lincoln "Softweld" Electrode is the answer to many a machinist's and welder's prayer for a weld metal that can be applied to gray cast iron for correcting machining errors, filling up defects, etc. This shielded arc electrode deposits a machinable non-ferrous alloy which bonds to the cast iron with minimum penetration or heating of the base metal.

. . . and After

The new "Linconditioner"

This new Lincoln shop air conditioner filters the smoke and removes the heat of welding and thereby contributes materially to the comfort of the man-at-the-arc, resulting in less fatigue and lower welding costs. Also it cuts the operating costs of the shop blower and heating system. Mail the coupon for Bul. 329.

Self-protected for faster welding

Self-protected against burnout, the new *"Shield-Arc"* can be operated at higher sustained loads. One user reports that because of this feature the *"Shield-Arc"* gives him 18% faster welding than he gets with welders of conventional design and equal capacity. Also, range is wider and operation is simpler because its Dual *Continuous* Control provides an *infinite* number of current and voltage combinations. Bul. 412 gives full details.

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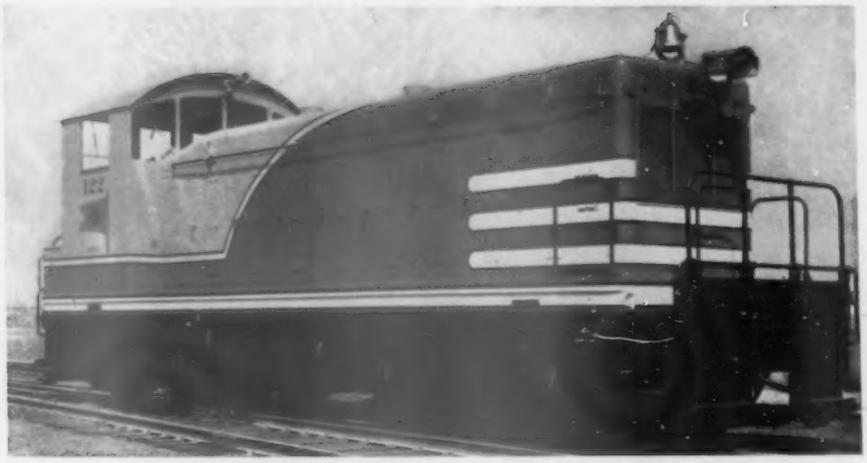


Diesel switcher built by Electro-Motive Corp. for Lehigh Valley R. R.

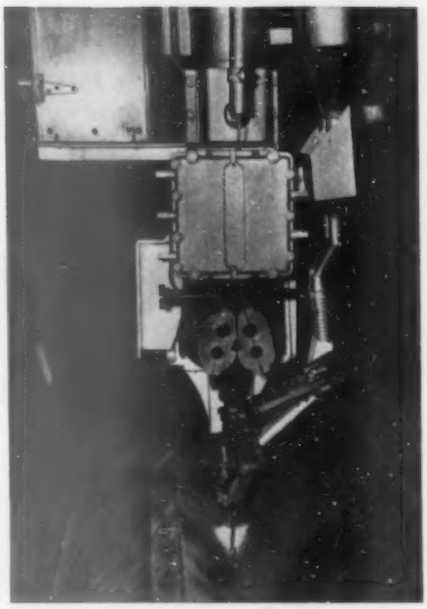
Diesel switcher fabrication utilizes

Automatic Welding Process

★ Heavy steel floor slabs (4¼-in. thick) automatically welded at speeds from 5½ to 6 in. per min.

FABRICATION of diesel-powered locomotives for switching service and for modern high-speed streamliners is accomplished with the aid of industry's major assembly tool—welding. In the La Grange, Ill., plant of the Electro-Motive Corporation, there are two installations of automatic welding by the "Unionmelt Welding Process," developed by engineers of The Linde Air Products Co. In this short article we will describe the largest installation in the plant and the one which is employed to weld heavy 4¼-in. steel slabs for diesel switcher underframes.

Unionmelt welding head and control equipment are mounted on a gantry crane.

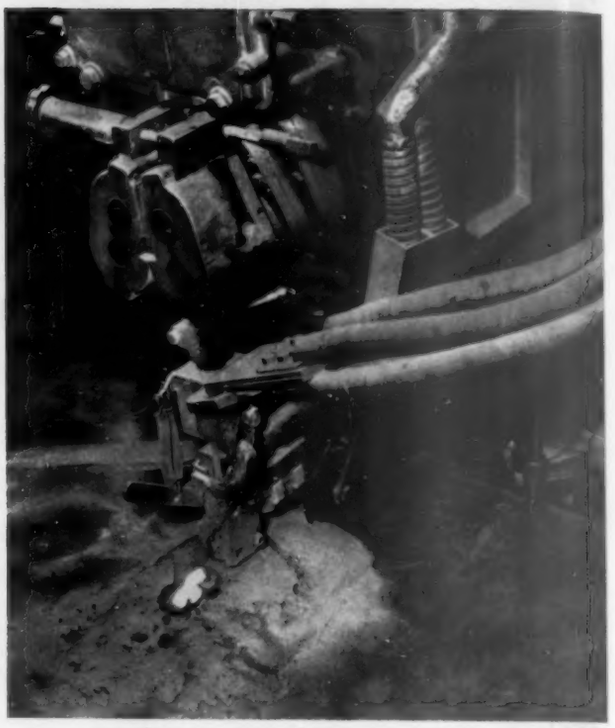


Close-up of the Unionmelt welding head.

It is necessary to use heavy steel slabs in order to obtain enough wheel load on the drivers to give the locomotive the tractive effort or pulling power needed in railroad switching service. Steel mills do not roll heavy slabs of this thickness in widths which would be suitable for locomotive underframes. It is, therefore, necessary to butt weld two slabs together to obtain the widths required for the locomotive frame.

In one of the illustrations, the operator is using the machine to make a double-vee butt weld in two fairly small 3⅜-in. thick steel slabs. On this

Starting the weld in two 3⅜-in. steel slabs used for a special production jig.



Nearing the end of the butt-welded seam on the two 3⅜-in. slabs.

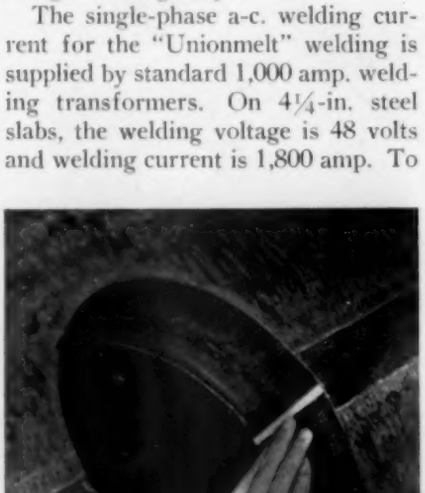
particular job (a special production jig) the welding speed is 5½-in. per minute. The welding head and the associated control equipment are mounted on a gantry crane which is motor-driven and moves along two guide rails at the desired welding speed. The welding head automatically feeds a 5/16-in. mild steel, bare welding wire into the welding zone. The wire reel is carried overhead on the bridge of the gantry.

The single-phase a-c. welding current for the "Unionmelt" welding is supplied by standard 1,000 amp. welding transformers. On 4¼-in. steel slabs, the welding voltage is 48 volts and welding current is 1,800 amp. To supply the current, three transformer secondaries are connected in parallel.

The automatic wire feeding mechanism is regulated by an ingenious voltage control working through the medium of thermionic tubes. When voltage across the welding zone increases, the automatic feed operates to feed in more wire. When the voltage drops, the control medium slows up the feeding of welding wire.

In starting the process, the operator employs a small ball of steel wool which he places in the welding groove at one end of the slab. The welding wire is then brought into contact with the steel wool, and completely buried with the special granulated welding composition called "Unionmelt" or simply "melt." When the heavy current is turned on, it immediately fuses the steel wool and then part of the powdered welding composition, thereby initiating the "Unionmelt" welding operation.

Though at the start the powdered melt is piled into the groove and around the electrode manually by the operator, once the weld is started the special welding head keeps a mound about 2-in. high just ahead of the traveling electrode. The heat of the welding current fuses part of the melt to a glass-like slag which remains buried beneath the unfused powder and stays at incandescent temperatures long after the weld metal beneath it has solidified and cooled. When it is fairly hard, the operator easily knocks off the solidified slag, leaving a bright, non-oxidized finish on the weld metal. A rather simple vacuum recovery system is employed to reduce waste of the unfused granulated Unionmelt. The operator removes the unused powder in much the same way as a housewife operates a vacuum cleaner to pick up dust and dirt.



Complete penetration is achieved in 4¼-in. slabs with two overlapping passes, one on each side.

Etched specimens studied in the metallurgical laboratory at the plant have indicated that the "Unionmelt" process obtains complete penetration in 4¼-in. slabs with only two overlapping passes, one on each side, each made at from 5½-in. to 6-in. per minute. Several advantages are claimed in the use of this automatic process. It is stated that the Unionmelt process speeds up production, minimizes residual stress and distortion, produces more uniform welds and protects the weld metal from atmospheric contamination.

The welds have been found to be of good quality under tensile, bend, shock, fatigue, and corrosion tests. Since they are made automatically and

the operator cannot even see the actual zone of fusion, the "human element" in welding is virtually eliminated.

The appearance of the welding operation is particularly striking because of the absence of arc flash. In welding the heavy slabs some of the molten "Unionmelt" occasionally comes to the surface, particularly at the start, as shown in the illustrations, but often complete welds are made without any visual evidence of welding action taking place beneath the layer of granulated material.

» «

Welding of Carbon-Molybdenum High-Pressure Power Piping*

★ Stress relieving of joints which have been preheated electrically is conveniently done immediately after completion of welding. Additional insulation is placed around the weld and the current is stepped up to provide the proper temperature. Where electrical preheating has not been employed, electric induction or resistance stress-relieving equipment is usually used. The weld is brought up to proper temperature and allowed to cool at the usual rate of not more than 250 deg. an hour.

Qualification of Process

Because of the necessity for having every weld in the piping system of uniform high quality, it is of utmost importance that a standard welding procedure covering all types of welds involved be developed and strictly adhered to. The American Welding Society Tentative Rules for Qualification of Welding Process and Testing of Operators, as revised in June, 1937, provide an excellent guide for establishing and recording, as a process specification, the definite limits of all essential variables. Chemical analyses and physical properties of all parent metals to be used in construction, trade and manufacturers' names of filler metals, design of all welds to be employed, preparation of base materials, welding technique and preheating, and stress-relieving procedure, should all be definitely specified in the process specifications.

The American Welding Society rules may also be followed in investigating the process and determining its ability to produce welds with the required tensile strength, ductility and soundness, as well as in qualifying both the process and the welding operators.

The method to be employed in qualifying the process and the operators should also be written into the general specifications for every project.

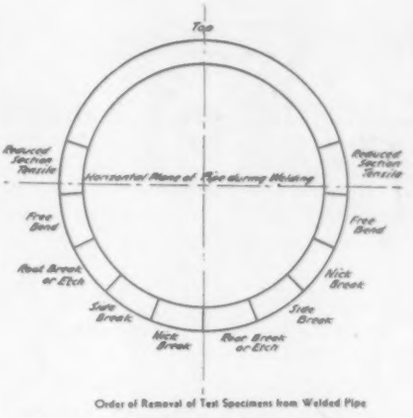


Fig. 10—Where test specimens are removed from sample welds to qualify the process (horizontal fixed position).

In qualifying the welding procedure under the above rules, the fact that welding technique may vary to suit three distinct conditions is taken into account; (1) pipe in the horizontal fixed or "B" position, requiring three-position welding; (2) pipe in the horizontal rolled or "A" position where pipe is rotated during welding; (3) pipe in vertical or "C" position, requiring only horizontal fillet welding.

Three pairs of complete specimen welds are first made up. Each pair consists of one weld made in pipe of the minimum wall thickness to be used in construction and one specimen weld made in pipe of the maximum wall thickness, except that the thickness of the pipe used for the second specimen need not exceed 1½ in. One pair of these specimen welds is made in the horizontal fixed position, another pair in the horizontal rolled position, and the third pair in the vertical position. If, however, the welding technique and design to be employed in the two horizontal positions is the same, the specimen welds made in the horizontal rolled position may be omitted.

From each of the sample welds ten coupons or test specimens are removed and prepared for testing:

2 Reduced section tensile specimens.
2 Free bend specimens.
2 Side break specimens.
2 Nick break specimens.
2 Etch specimens.

For horizontal fixed position welds, these specimens are removed and prepared in the order shown in the pipe section Fig. 10. For welds made in other positions they may be taken in any order, except that no two specimens of the same type are removed adjacent to each other. The specimens are tested in accordance with the methods described in the American Weld-

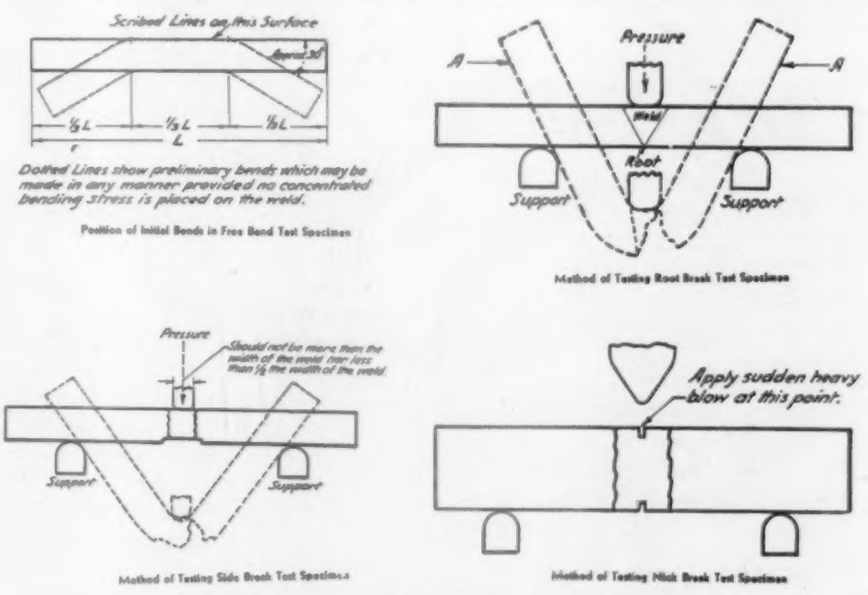

Scribed Lines on this Surface
Bend 30°
½L
½L
½L
L
Dotted Lines show preliminary bends which may be made in any manner provided no concentrated bending stress is placed on the weld.
Position of Initial Bends in Free Bend Test Specimen
Pressure
A
A
Weld
Root
Support
Support
Method of Testing Root Break Test Specimen
Pressure
Should not be more than the width of the weld nor less than ⅛ the width of the weld
Support
Support
Method of Testing Side Break Test Specimen
Apply sudden heavy blow at this point.
Method of Testing Nick Break Test Specimen

Fig. 11—Physical test specimens required in the qualification of the welding operators.

* Continued from July, 1938 issue, pages 25-28.

ing Society Rules and shown in Fig. 11. Reduced section tensile specimens are intended to show strength and soundness of welded joints, and the tensile strength of the weld metal in such specimens should be at least equal to the minimum specified tensile strength of the pipe. Free bend tests are designed to show the ductility of the filler metal and such specimens should show an elongation of at least 30 per cent. Root-break, side-break and nick-break specimens are made for the purpose of investigating soundness of deposit. They should show in the fractured surfaces, complete penetration throughout the entire thickness of the weld and total absence of oxide and slag inclusion, cracks and lack of fusion and root penetration. A limited number of small gas pockets (1/16-in. in diameter or less) is permissible, the general rule being not more than six to a square inch.

If desired, instead of the above rules, the testing methods outlined in the Code for Pressure Piping of the American Standards Association may be followed in qualifying the welding procedure.

Qualification of Operators

Having established by the above tests that the welding process is satisfactory, the next step is the testing and qualifying of welding operators to determine their ability to produce welds of the desired quality.

Qualifying tests for operators are limited to those intended for determination of lack of soundness in the weld. Testing may be done in accordance with either the American Welding Society Rules for Testing of Welding Operators, or the Code for Pressure Piping of the American Standards Association.

When the American Welding Society Rules are being used, each operator is required to make one test weld in the horizontal fixed position and one test weld in the vertical position. The diameter and thickness of pipe used for these welds is generally the maximum to be used in construction, but must not be less than 4 in. standard and need not be more than 8 in. double extra heavy. From each of these test welds the following coupons are removed and prepared for testing:

2 Face-bend specimens.
2 Root-break specimens.
2 Side-break specimens.

These specimens are removed from the test welds made in the vertical position in the order named, while from welds made in the horizontal fixed position they are removed as shown in the pipe section, Fig. 10.

In addition, for further investigation of weld soundness, a pair of etch specimens are often made. The etch test specimens are taken at locations which would best reveal any lack of soundness.

All specimens are tested in accordance with the American Welding Society Rules, as shown in Fig. 11. They must meet the same requirements as the corresponding specimens for qualifying the welding process.

In case an operator fails to qualify, he may either take an immediate retest, or may postpone the retest for one week in order to obtain further training or practice. At any time during construction, if there is any definite reason to question a welder's qualifications, he may be required to requalify.

» «

Ninth Edition of The Welding Encyclopedia Just Off the Press

★ This practical reference book dealing with all of the welding processes in commercial use has just made its ninth appearance in a completely re-edited volume prepared by Stuart Plumley. Since the publication of the eighth edition more than six years have elapsed during which time the welding industry has witnessed a number of major engineering developments. Since the publication of the first edition in January, 1921, under the editorship of L. B. Mackenzie, the book has kept in step with the rapid growth of the industry.

A feature of the new edition is the arrangement of subject matter in alphabetical order so that reference data can be located as quickly as in a dictionary or telephone book, without consulting an index. A large part of the Ninth Edition has been completely re-written, particularly the sections dealing with arc welding. As in the past editions, the new Ninth Edition includes a complete list of trade names. Company names have been inserted alphabetically, listing in each case all of the trade names used on that company's products. This feature enhances the value of the Welding Encyclopedia as the standard trade directory of the industry.

It is evident from checking through the pages of the Ninth Edition that the Editor has emphasized the practical and commercial aspects of welding. The book has been designed primarily to meet the needs of the practical man who must apply the welding processes. Although the book contains considerable engineering data, less emphasis has been placed on the purely technical and research aspects of welding, with the purpose in mind of making the book of maximum value to the practical man in the shop or out on the firing line in the field. The Ninth Edition is thus presented to the welding industry as a practical book to supplement the excellent engineering text books and engineering publications currently available.

From the following list of principal subjects, the reader will gain a bird's eye picture of the contents of the Ninth Edition:

Acetylene—Agricultural Implements and Machines — Aircraft Structures — Aircraft Welders — Aluminum — Annealing — Automotive Repair — Boiler Sections — Boiler Welding—Business Methods—Calcium Carbide—Carbon—Cast-Iron—Copper and Its Alloys — Cutting Metals — Electric Arc Welding — Electric Resistance Welding — Firebox Welding—Flame Hardening—Galvanized Iron—Hard Facing—Jigs and Fixtures—Lead Welding—Locomotive Cylinders and Frames — Machinery — Malleable Iron — Manganese Steel — Metallography — Metal Spraying—Monel Metal—Nickel—Nickel-Clad Steel—Nickel Alloy Steels—Oxy-Acetylene Welding—Pipe Welding—Plow Shares — Preheating — Rail Bonds — Rail Joints—Rules, Regulations, and Codes —Sheet Metal Welding—Silver Soldering and Brazing— Soldering—Specifications for Materials—Stainless Steel—Structural Steel —Surface Hardening—Tables and Charts—Tank Welding—Testing and Inspection of Welds—Thermit Welding—Tools, Welding of—Track Welding—Training Operators—Welding Rods and Electrodes — Welding Symbols—White Metal—Supplement—Catalog Section.

A catalog section on India tinted stock is included as the final section of the book. Here will be found the advertisements of sixty-seven com-

panies manufacturing welding equipment and supplies. A two-page buyer's index is in the catalog section.

Copies of the Ninth Edition of the Welding Encyclopedia (696 pages, 5⅝ in. x 8¼ in.) can be obtained by ordering direct from The Welding Engineer Publishing Co., 608 South Dearborn St., Chicago, Ill. The book will be sent anywhere in the United States, Canada, or foreign countries for $5.00 postpaid.

» «

A. W. S. Publishes The Welding Handbook (1938 Edition)

★ The first edition of the Welding Handbook of the American Welding Society made its debut during July. This volume represents the effort of 90 authors supplemented by 237 reviewers, under the editorial direction of a special Handbook Editorial Committee of which D. S. Jacobus is chairman. Other members of the Editorial Committee which directed this big job are: C. A. Adams, F. T. Llewellyn, C. W. Obert, and W. Spraragen.

As explained in the preface, the committee selected outstanding authorities for the respective chapters and then invited at least five other authorities to review each chapter. As the official publication of an engineering society, a determined effort was made to present information impartially. It was the aim of the committee according to the preface, "That statements of fact shall be accurate and the recommendations authoritative." The reader, however, may become confused when he learns further in the preface that, "While the Editorial Committee has endeavored to insure the reliability of the information given, it wishes to emphasize the fact that the opinions presented, and the terminology used, by the several authors in their respective chapters, must be considered as individual expressions which are not necessarily endorsed by the Committee or the Society as a whole."

An excellent arrangement of subject matter is quickly noticeable. First, the book covers the fundamentals of the various welding processes; second, the materials and metallurgy of welding; third, testing methods; and fourth, a diversity of welding applications. To gain an understanding of the scope of the book we present the following digest of subject headings:

GENERAL SECTION—Economics of Welding—Chart of Welding Processes and Definitions of Terms—Welding Symbols and Instructions for Their Use.

WELDING PROCESSES — Fundamentals of Arc Welding—Alternating Current Arc Welding—Shielded Arc Welding—Automatic Arc Welding—Automatic Carbon Arc Welding—Fundamentals of Gas Welding—Atomic Hydrogen Welding—Fundamentals of Resistance Welding—Fundamentals of Spot Welding—Automatic Resistance Welding—Resistance Welding Electrodes—Resistance Welding Controls—Thermit Welding — Oxygen Cutting — Arc Cutting—Soldering and Brazing—Facing or Surfacing by Welding—Metal Spraying—Flame Hardening—Stress Relieving.

MATERIALS AND METALLURGY — Metallurgy of Welds—Carbon Steels—Low-Alloy Steels—Chromium Irons and Steels—Austenitic Manganese Steel—Copper and Copper Alloy—Aluminum and Aluminum Alloys—Nickel and Nickel Alloys—Filler Metal Specifications.

TESTING METHODS—Standard Qualification Procedure—Non-Destructive Tests—Fatigue Tests—Strength Tests of Resistance Welds—Inspection of Welded Pressure Vessels—Some Navy Testing Practices.

WELDING APPLICATIONS—Safe Practise in Welding and Cutting—Jigs and Fixtures—Ships, Barges and Hulls—Pressure Vessels—Boilers — Storage Tanks — Pipe Lines—Pipe and Tanks—Resistance Welding—Piping and Fittings—Cast Iron by Bronze Welding—Machine Structures—Economy in Welded Machinery Design — Buildings — Bridges — Automotive Products — Aircraft Structures—Railroads and Railways—Underwater Gas Cutting—General Maintenance and Repair.

CRITICAL DIGESTS OF WELDING LITERATURE—Wrought Iron—Malleable Cast Iron—Cast Iron—Cast Steel—Corrosion Resistance of Welded Joints—Shrinkage Distortion in Welding—Heat Effect in Welding—Stress Distribution in Fillet Welds.

This 1200 page book carries a very complete index at the back to assist the reader in locating any subject he may be interested in. The subjects have been cross-indexed for quick reference. Copies of the Welding Handbook 1938 Edition, published by the American Welding Society, 33 West 39th St., New York City, are priced at $5.00 to members of the American Welding Society and $6.00 to non-members. The foregoing prices apply to the United States; elsewhere the book sells for $6.50.

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Welding Enters the Home

★ Herbert R. Isenburger, of St. John X-Ray Service, Inc., 30 Thomson Ave., Long Island City, N. Y., sent us a photograph of his living room at home to prove that he is welding-minded. Inspection of the photograph reveals an all-welded brass table and welded lighting fixtures along the top of the book shelves. The latter can be turned up to reflect light from the wall and ceiling to light the room indirectly. When titled downward they give a good reading light. It is made up of two sections of sheet metal.

The cocktail table is more complicated and a unique welded frame has been worked out to support the heavy glass plate.

Welded furniture adds simple dignity and charm to living room.

Technical development
in relation to

Employment—Wages—Prices

★ An economist reviews events which led up to the current recession in industry. Period immediately ahead looks promising but political uncertainties retard return of confidence

By **HAROLD G. MOULTON***
President, The Brookings Institution, Washington, D.C.

THE great economic changes of the past 20 years and the accompanying political upheavals have made it increasingly apparent that we are living in the midst of what may be called an era of profound historical change, the ultimate consequence of which no one can now forsee.

The simple truth is that we are all interested in a common goal, namely, that of higher standards of living for the population as a whole. Our disagreements relate almost entirely to the methods by which the desired goal is most likely to be attained. The differences which exist here arise in the main out of differences in knowledge and understanding with respect to the forces and factors which control the operation of the economic system.

The problem before us is of special interest to engineers. Traditionally, the engineer properly has looked upon his profession as of fundamental importance in the larger scheme of things. It has been through engineering that the great discoveries of science have been made available for the service of society and in consequence, the function of the engineer has sometimes been extolled almost to the exclusion of other contributing factors in economic progress. But the events of the last decade have given rise to a baffling situation for the engineering profession. Reference is here made, not only to the slackness of employment at present, but to an apparent damming up of the whole process by which engineering knowledge is transformed into productive energy.

More significant still, science itself is facing a question mark. Have we made too many scientific discoveries and is it becoming necessary to halt the advance of science? Some of our most eminent scientists are asking whether, as the years pass, science will continue to be a beneficient power advancing the welfare of society or whether it may prove a sort of Frankenstein monster which may ultimately destroy civilization.

The engineering attitude with respect to economic progress has always been direct and fundamentally simple. Moreover, its validity is not open to challenge. It is based upon the elementary assumption that the function of engineering is to apply the new knowledge that is continuously accumulating, to the improvement of productive instruments and processes, with a view to increasing the efficiency of mankind in adapting natural resources to the satisfaction of human wants. Increasing efficiency simply means producing more with the same effort, in consequence of which standards of living will or should be raised.

The nature of the problem is, however, complicated by the fact that under the capitalistic system, production is carried out through financial processes. Business managers use money in the hiring of labor and in the purchase of materials and supplies and they sell their products for money. The aggregate amount of money received from sales must, of course, exceed the aggregate costs if profits are to be realized. Thus, business and in turn engineering, has its setting in a structure of monetary costs, prices, and profits; and the economic requirements for progress must accordingly be analyzed in these financial terms.

The Profit System

The incentives and mechanisms by which the competitive system has been imposed to ensure rapid economic progress and higher standards of living may be briefly summarized as follows:

First, it is contended that each business manager naturally stands to gain by increasing efficiency and thereby reducing costs. He may accomplish this by the construction of a larger and more efficient plant; by the installation of better equipment; by the introduction of superior internal management; by improved methods of marketing; or by a combination of these various methods.

Second, having reduced costs of production, he is in a position to increase his profits in one or the other of two ways. He may continue to sell at the same prices as before, enjoying the advantage of a wider margin between cost and selling price, or second, he may expand the volume of his business by means of price concessions. It was reasoned

*Abstracted from recent addresses before engineering societies and advertising groups (most recently before Chicago Federated Advertising Club).

What's ahead in the durable goods industries, where welding engineering has made its greatest strides? Dr. Moulton, an acknowledged authority, presents an engineering approach to a complex economic problem. A period of intensive activity in capital goods seems a very likely possibility in the near future, but present political uncertainties are delaying its development.

Deficiencies in the productivity of capital goods now in service are lowering the standard of living of millions of wage earners. This must be corrected by an extensive program of rebuilding and replacement of production facilities. Welding will undoubtedly play a major part in this important task.—(Editor.)

that since the increase in efficiency, which is responsible for the reduction in costs, commonly involved an expansion of productive capacity, and since the maximum economies can be attained only when operating at full capacity, the greatest profit will result if sales are expanded by means of a reduction of prices. In short it was held that increased efficiency makes possible lower prices, while the profit incentive insures an actual reduction of prices.

Third, the process naturally involves the elimination of obsolescent or otherwise inefficient high cost establishments. The industrially fit, as gauged by an ability to sell at a minimum price, alone survive. Moreover, the efficient of today promptly become the inefficient of tomorrow. A particular businessman, firm, or corporation may indeed survive over a long period of years, but only if the production methods employed keep always abreast of changing times.

It will be seen that with a system thus operating, standards of living would steadily rise. The progressive reduction of prices as efficiency increases would, of course, constantly expand the purchasing power of the masses, giving them an increasing volume of goods for the same money.

It should be carefully noted that this theory of progress implies that a reduction in money costs must result from increased efficiency rather than from a mere reduction in hourly wage rates. A reduction in wage rates may indeed lower money costs and prices but since it increases neither efficiency nor the purchasing power of the masses, there is no resulting advancement.

Degree of Recovery

At the present moment, our minds are naturally focussed upon the new business reaction which began in the early autumn of 1937. Every one is asking whether we are in for another major depression comparable to that which began in 1929, or whether we are confronted merely with a period of minor readjustment. I am not interested in forecasting the fluctuations of the stock market or the duration of the present depression. Political and other factors play so powerful a role in these days that it is impossible for either economist, statistician, or business seer to foretell with any certainty the outcome of current trends.

It is necessary to bear in mind that since 1929 the population of this country has increased approximately six per cent and the population of working age by nearly 10 per cent. In *per capita* terms, the present national income is less than 85 per cent that of 1929.

Even this figure does not reveal the full extent to which our position has deteriorated since 1929. In our production of consumption goods, where we have attained most nearly to predepression levels, we have been continuing to use plant and equipment constructed before 1929, much of which has deteriorated or is of an obsolete pattern and is in serious need of replacement in the interests of productive efficiency. Accordingly, if we are to restore standards of living to the predepression level or higher, we must, in order to make good these accumulated deficiencies, have a level of production for some years to come substantially above that of 1929, while we are making up these arrearages.

Production Requirements

The production task before this country may be stated in the following terms:

First, to make good the actual deterioration of plant and equipment, sustained during the depression. Second, to increase productive capacity in proportion to the growth of population that has occurred. And third, to expand the output of consumption goods in accordance with this growth of population.

Popular thinking centers mainly on the last of these requirements, that is, the increase of consumption goods. But the achievement of this goal depends fundamentally upon the fulfillment of the first two requirements; namely, making good the deficiencies of plant and equipment resulting from seven years of subnormal replacement, with depreciation and obsolescence continuing, and also expanding the rate of capital growth in proportion to the rate of population growth that has already occurred.

We studied the situation in the fields of housing, passenger automobiles, other durable consumer goods, steam railroads, public utilities, and industrial and commercial enterprises. Each of these studies involved taking account of the restricted rate of replacement during the last seven years and the requirements also resulting from the continued growth of population. Taking the whole field of durable goods into account and stating the results in aggregate terms, we found that the volume of production over the five years from 1937 to 1941, inclusive, would have to be roughly 60 per cent greater than it was in 1936, and approximately one-third greater than it was during the boom period of 1925 to 1929. Stating these requirements in terms of dollars, we did produce in the field of these durable goods in 1936, about 21 billion dollars' worth; (that is, out of that 64 billion dollars' worth of goods and services, about 21 billion dollars was in the field of durable goods). We would have to produce instead of 21 billion dollars annually over the next five years, about 33 billion dollars' worth, if we are to restore living standards to the level of 1929.

The increase in productive efficiency during the course of the depression years has not been sufficient to offset our failure to increase the supply of productive capital. While there has been a substantial advance in man-hour productivity in manufacturing

Higher Standards of Living

"First, the process of raising the standards of living of wage earners necessarily involves increasing the ratio between wage rates and prices. If the wage earner gets more dollars and prices remain unchanged, his purchasing power is expanded. If he gets the same number of dollars and prices decline, his purchasing power is expanded. But it can be expanded only by increasing wages in comparison with prices.

"Second, an increase of wage rates relatively to prices depends fundamentally upon increasing the efficiency of production. Only thus will the means be available with which to pay higher real wages and provide more goods and services. Accordingly, there must be a constant acceleration of technical advances, improvement management, increased labor efficiency, and so forth. Any practices or policies that tend to work in this direction may be regarded as economically sound, and any that tend to work in the opposite direction must be pronounced economically unsound."

industries, the same has not been true to anything like the same degree in other lines of production. For the economic system as a whole, the increase in man-hour efficiency is, according to our studies, much less than ten per cent.

The simple truth of the matter is that we have not yet reached a stage of technological development at which it is possible for the American people to attain the standard of living which they desire with working time as short as that which now prevails in American industry. Bear in mind that the estimates of production which I have here presented have assumed a return merely to 1929 levels. What we need, of course, is much higher levels than these if we are to have a standard of living to which we aspire. Our research reveals that anyone who favors a further general reduction in the length of the working week at this stage of our economic development is unwittingly favoring lower standards of living.

Wages and Prices

Business activity involves the sale of goods in the market for money and the disbursement of the income accruing to those who participate in the productive process in the form of money—as wages, interest, profits, and so forth. The successful operation of this system requires adherence to two fundamental principles.

First, *the process of raising the standards of living of wage earners necessarily involves increasing the ratio between wage rates and prices.* If the wage earner gets more dollars and prices remain unchanged, his purchasing power is expanded. If he gets the same number of dollars and prices decline, his purchasing power is expanded. But it can be expanded only *by increasing wages in comparison with prices.*

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Upsetting the "Apple Cart"

"In the first quarter of 1937 came the development primarily responsible for destroying the existing balance and altering the whole course of events. I refer to the aggressive labor movement which succeeded in obtaining for a large part of American workers a substantial reduction in the length of the standard working week and substantial advances in rates of pay.

"Now whereas the gradual increases in wages during the preceding three years had been accompanied by roughly proportional increases in efficiency, the sharp advances of 1937 were wholly unrelated to efficiency. Indeed, the accompanying industrial warfare meant inevitably a decrease in efficiency for the time being. Hence an advance in prices appeared necessary if profits were to be maintained."

Now, it is this second principle—and let me emphasize this with all the power at my command—that is so commonly overlooked in all public discussions of wages, prices, and purchasing power. Attention has been concentrated upon increasing the flow of *money* income: first by reducing the number of hours worked, thereby increasing the number employed; and, second, by raising the rates per hour. Little thought has been given to the increase in productive efficiency and productive output which *alone make higher real wages possible.*

With these principles in mind, I want now to review the course of the recent recovery movement. During the summer of 1933, wage rates were sharply increased as a result of the code agreements under the NRA. Prices advanced quickly but not quite proportionately. Then from 1934 until the third quarter of 1936—please note these dates carefully—from 1934 until the third quarter of 1936, wage rates continued to increase at a moderate pace, while the prices of manufactured goods remained practically stable. Now, during this period productive efficiency was materially increased—in fact, in rough proportion to the increase in wage rates.

The economic results of these trends were as follows: One, the increase in productive efficiency and the fuller utilization of plant capacity resulted in lower unit costs. Two, the increase in wage rates as compared with prices, steadily expanded the purchasing power (in real terms) of employed industrial workers. Three, the expanding volume of sales led to increased profits, the reduction in unit costs more than offsetting the increase in wage rates.

Changes in 1937

The trends up to late 1936 were thus distinctly favorable from the standpoint of these relationships. Production was steadily expanding and unemployment decreasing. Purchasing power was being broadly disseminated among the masses. Speculative business activity was not strongly in evidence and the general balance between current production and current consumption appeared reasonably satisfactory, and if the existing favorable balance could have been maintained, there was good reason for hoping that we might be entering upon a period of exceptional prosperity that would in a few years go far toward restoring the economic losses from the depression.

It was apparent at the end of 1936, however, that forces were at work which threatened the equilibrium between wages and prices. In an address before the National Association of Manufacturers in December 1936, I made the following statement:

"The generally favorable price situation appears to be in imminent danger of succumbing to pressures and temptations inherent in the immediate situation. In the last quarter of 1936, tendencies have developed which threaten a reversal of recent policies. Increases in taxes, rising prices of important raw materials, and demands for further substantial increases in wages are exerting a powerful pressure in the direction of rapid price advances. These are very real forces, perhaps irresistible."

In the first quarter of 1937 came the development primarily responsible for destroying the existing balance and altering the whole course of events. I refer to the aggressive labor movement which succeeded in obtaining for a large part of American workers a substantial reduction in the length of the standard working week and substantial advances in rates of pay.

Now whereas the gradual increases in wages during the preceding three years had been accompanied by roughly proportional increases in efficiency, the sharp advances of 1937 were wholly unrelated to efficiency. Indeed, the accompanying industrial warfare meant inevitably a decrease in efficiency for the time being. Hence an advance in prices appeared necessary if profits were to be maintained. Amid the stress, confusion, and fear that existed, prices were rapidly advanced, and a vicious spiral of rising costs, rising prices, and further increase in costs appeared in prospect.

Industrial production increased between the third quarter of 1936 and the second quarter of 1937 only a little, the index number rising from 115 to 117. Meanwhile, however, profits in manufacturing industries did not suffer. This is because an increase in prices proportional to the rise in wage rates was not necessary in order to maintain profits, since wages constitute only one item in the list of costs. The fact is that in the second quarter of 1937, the index of earnings of 120 industrial companies was 5 per cent above the excellent fourth quarter of 1936, and 20 per cent above the level of the first quarter of 1937. One must conclude, therefore, that so far as manufacturing industries were concerned, the price advances were somewhat greater than was necessary to maintain existing profit margins.

With railroads and public utilities the story was entirely different. The rising costs here could not be passed on in the form of increased prices immediately. Hence, profits were adversely affected almost instantaneously. Railroad earnings dropped nearly one-third in the second quarter of 1937 as compared with the last quarter of 1936, and public utility earnings declined by about 14 per cent. Subsequent wage increases, justified by higher living costs, have further complicated the railroad situation and set the stage for an insistent demand for higher rates as the only hope of forestalling another breakdown of the railroad financial structure. It is by no means certain that higher rates, particularly at this juncture, would accomplish the desired purpose.

Housing Industry

In a similar way, sharply rising costs and prices have pinched the housing industry and arrested the vitally needed expansion which was just beginning to get underway. Despite the need for housing, rents had been rising but slowly. Hence with the advance in building material prices and wages, the profit margin was again reduced and building commitments again lagged.

The factors responsible for checking the expansion movement, checking it long before we had recovered from the destructive effects of the last depression, can thus in this instance be definitely traced. The only element of surprise was the rapidity with which the succession of events brought the business reaction. Early in the year, it seemed possible that the purchasing power of ultimate consumers might be so large as to offset the adverse effects of disruption occurring elsewhere and insure large activity for the balance of the year. It should be pointed out in this connection that during the first half of 1937 with wages up some 15 per cent, the cost of living index, which is based on retail prices and includes rents, was less than 3 per cent higher. Thus for the time being the purchasing power of labor was substantially increased, while that of nonwage earners was reduced only a little. Indeed, farm income was higher. That was due to favorable crops and good prices in the United States as a result of crop failures elsewhere. Despite the increase in purchasing power among the masses of consumers as a whole, the break came quickly—more quickly, I am frank to say, than I had anticipated

Problem of Readjustment

Looking forward to the future in the light of the recent past, we may, I think, define with some clearness the requirements for returning prosperity. There must be a reversal of the trends which produced the maladjustment of 1937.

The extraordinary sharp decline in production schedules while consumption was continuing at somewhere near normal levels has been a favorable factor in that it has made for a rapid reduction in accumulated inventories. Already in some lines the inventory situation appears definitely improved.

Consumer Goods Outlook

"In December, 1935, the raw material index stood at 77.3 as compared with the manufacturing index of 82.8 or five points below. In January, 1937, the figure was 88.8 for raw materials as compared with 85.6 for manufactured products. But at the end of the year, in December, 1937, the index for manufactured goods remained practically unchanged at 85.4, while the raw materials index had dropped back from 88 to 75, or below the level obtaining throughout the year 1935. This decline of 15 per cent is of great importance. Meanwhile, some readjustments in wage costs are occurring and undoubtedly an increase in efficiency is accompanying the clearing of the atmosphere in the field of industrial relations. It is thus by no means impossible that a substantial increase in productive activity in the field of consumer goods might come in the course of the next few months. I do not pretend to know, but it is possible."

Similarly the sharp reduction in raw material prices that has occurred should be of genuine benefit to manufacturing industries.

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If the political skies could be cleared and agreements be reached with respect to a comparatively few major issues, the foundations would be laid for a period of remarkable economic activity in the rehabilitation of plant and equipment and in the expansion of new capital and durable consumer goods in line with the growth of population and with the companies' consumptive requirements.

The immediate outlook is thus shrouded in uncertainty. There are obviously such conflicting trends and political and psychological influences that no one is warranted in making confident prediction with respect to the next few months.

In periods of great social travail, there is an inevitable tendency to believe or hope that revolutionary changes may quickly usher in the golden age—by some uncanny legerdemain give us a short-cut to the promised land of plenty. Unfortunately, reflection upon the long, long story of human progress and analysis of the underlying requirements for economic advancement afford little support for such dreams. Despite the phenomenal achievements of modern science, of engineering and of business organization, for generations yet to come it will be necessary to be content with something less than the millenium.

Best Techniques For Welding Stainless Steel

By V. W. WHITMER*

★ While there will be a sharper line or less diffusion noted between the deposited and base metal when 18-8 is used for both rod and plate than in the case of 18% chromium, there will be a good bond between the two when welding is properly done.

Straight Chromium

In the straight chromium field the alloy containing 18% chromium, is the most common. This type requires the same procedure in welding as the chromium-nickel variety, the only difference being that less warpage is likely to occur, due to its low expansion, and that the welds will be hard and comparatively brittle, due to its martensitic structure. In the lower chromiums, such as 12%, the welds can be toughened quite well by annealing, but in the higher alloys with 18% or more chromium they do not respond satisfactorily to annealing or heat treating, although if proper welding procedure is followed they can be softened to some extent by annealing for eight hours or so at 1450 deg. F. These alloys at room temperature in the as-welded state are so brittle that they will snap at the slightest deformation.

While these welds will be brittle at room temperature, if raised to a few hundred degrees they will show considerable toughness, sufficient at times to bend about 90 deg. before breaking. In a recent test a sample of carbon steel fire-box plate welded to 18% chromium stainless with 18% chromium wire, bent about 80 deg. without breaking when heated to 400 deg. F.

Due to its low coefficient of expansion, which is even lower than mild steel, 18% chromium is much less liable to introduce difficulties than the other type. In some cases this is the deciding factor in determining its use. It is this property, along with its high blue brittle range, that explains why it gives such good service in locomotive fire-boxes where the movement, due to expansion and contraction on heating and cooling, is considerably reduced.

A pair of 18% chromium side sheets installed in a freight locomotive, after running 75,000 miles showed absolutely no signs of corrosion, buckling or cracking, while a set of regular carbon steel fire-box plates applied at the same time to another engine of the same type and operating in the same area, showed after 75,000 miles numerous radial cracks around the staybolts, deep corrosion around the mud ring and some buckling between the staybolts. Furthermore, very little scale adhered to the stainless plate on the water side, compared to the mild steel. This was probably due to the lower expansion of the stainless causing the scale to crack off and be removed at each washing.

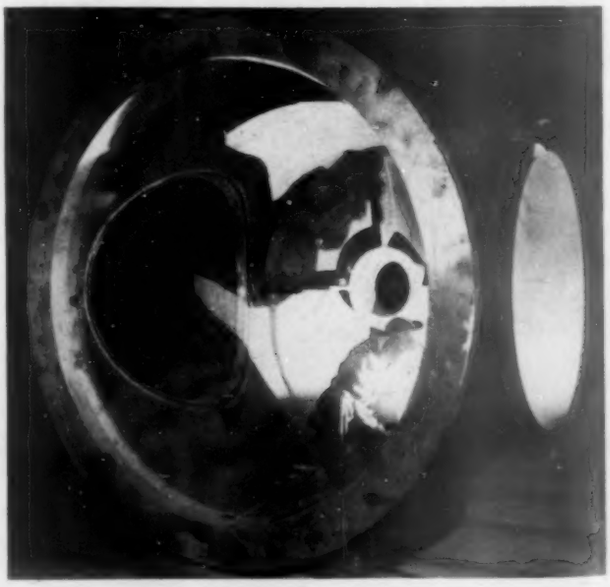
In this case the stainless was welded directly to the carbon steel. The operating temperature of this locomotive, around 500 deg. F., is in a range where these welds are tough; hence, no trouble was experienced from this angle. Considerable difficulty might have been encountered if the operating temperature were around 100 deg. F.

Recently an entire locomotive fire-box, including side, crown, flue, door sheets and syphons, was fabricated from 18% chromium, using an all arc-welded construction. This locomotive to date has run more than 60,000 miles in a bad water condition and is giving no particular trouble. No corrosion or metal failures have developed and the scale on the water sides cracks off after each washout, maintaining a practically scale-free surface.

Use 18-8 Rod

While it is best practice always to use welding rod the same as the metal being welded, it is sometimes necessary to deviate from this practice to a certain degree. For instance, if a patch were to be welded in a straight chromium plate and no provision for contraction were provided, it would probably be necessary to use a chromium-nickel wire, as the strain on the weld on cooling would snap a straight chromium bead. Due to greater strength and extremely high ductility, an 18-8 weld would hold. This practice has been followed in several cases with good results on straight or flat sections where the 18% chromium welds failed.

The high temperature employed in welding, whether on chromium or chromium-nickel, will discolor the metal for a short distance on each side of the weld. This is a surface condition only, being nothing more than an oxide. It can easily be removed, either by some form of pickling or by grinding and polishing with abrasive wheels and grits, after which the metal underneath will be in the same condition as before welding. That is, the oxide on the surface does not affect the metal beneath it. If this oxide is not removed and the surface becomes wet



Stainless steel valve seats used on this huge cone valve, claimed to be the "world's largest" —Photo, courtesy of Electromet Review.

* Welding Engineer, Republic Steel Corp., Cleveland, Ohio—This is the second installment of Mr. Whitmer's article, which began last month.

Strength, safety and corrosion resistance are assured with welded stainless steel centrifugal baskets—Photo, courtesy of Electromet Review.

and dry, it will change from a blue color to a brown, resembling iron rust, along these areas. This likewise will be a surface condition only.

Projection Welding

Projection welding is a form of variation of spot welding in which small projections or buttons are raised on one side of a sheet or plate at the spots where it is to be welded to another sheet. When these two plates are put together and placed between the electrodes and pressure applied, the projections themselves act as pointed electrodes in localizing the heat. In this way numerous welds are frequently produced between two sheets in one operation. The projection as originally made will, of course, have a depression or deep indentation on the one side. This will still be present in the finished weld, but due to its greater depth in comparison to one side of a spot weld the opposite side will as a general rule tend to produce a more even surface than the average spot weld. When welding polished stainless, it is advisable to place the welds in the least conspicuous positions, as often it is difficult to refinish the welds and have the same color if the whole piece is not refinished. This depends, to a great extent, upon the finish of the sheets.

Spot welding, like any other type of welding requiring high temperature, will form an oxide on the surface which will be blue in color. If this is exposed to the weather or moist conditions it will slowly change to a brown color resembling rust. This is merely a surface condition, affecting the original oxide only. If such welds are to be exposed to the atmosphere, they should be cleaned either with acid as in pickling, in the case of No. 1 finish sheet, or ground and polished, if No. 4 or higher finishes are employed. In the ground and polished state, spot welds have withstood several hundred hours salt spray without the least sign of attack.

Shot welding is also a form of spot welding, but employs a higher voltage and shorter time, producing less heat on the surface. It tends more completely to confine the heat to the junction of the two sections being welded. The method, therefore, produces less oxide or discoloration in general on the surface than ordinary spot welding.

Seam Welding

Seam welding, frequently known as resistance or line welding, is similar to spot welding in principle. Instead of using two electrodes in making one weld at a time, a roller is applied on both electrodes and the work is fed between these, as a continual series of intermittent welds is produced. Various machines employ different methods of producing this intermittent effect, but in nearly all cases the resulting weld is a series of overlapping spot welds, as can be noted by a stitch effect on the surface. The adjustment or manipulation is similar to that for spot welding. It should be remembered however, that the range for welding the chromium and chromium-nickel is considerably more narrow than common steel and because of this a closer adjustment is of vital importance.

Valve seats of stainless steel resist corrosion, erosion and abrasion—Photo, courtesy of Electromet Review.

Water-tight welds are produced by this method in production work. This shows two flat stainless 18-8 sheets seam welded together around the outside. A pipe coupling was soldered over a hole drilled in the center of one plate. Hydraulic pressure was applied and plate blown up as shown without a leak appearing in the weld. This type of welding is used extensively in the manufacture of light sheet metal containers or packages.

Flash Welding

Stainless steel can be flash welded much like ordinary steel products, provided certain conditions are observed as noted before. In this type of welding the two sheets or bars to be joined are held in grips approximately 1/2 in. or so from the edges, depending on the section. The current is turned on, the edges brought together and a certain amount flashed off, during which period the metal is coming up to welding heat. At the proper time the current is shut off and the two edges squeezed together or upset, producing a burr along the outside which, when ground or chipped off, shows a solid weld beneath.

A close adjustment of all these operations is very important with stainless as compared to ordinary steel. For instance, if the metal is too hot or the time between the flash and upset is too long, part of the metal will flow away like water, leaving a hole in the finished joint. In producing the actual upset, the first stage should be very rapid, followed by a slower movement than with steel. This will keep the very fluid nearly molten metal from dropping away at first and the slower and final movement will allow the metal to upset evenly instead of crawling irregularly from one side to the other. When conditions are right, this joint will be solid.

It is necessary, therefore, that automatic control of all stages be employed. The two edges along the joint should be as uniform and straight as possible in order to start heating or flashing along the entire section at the same time to prevent over-heating or loss of metal at any one point, as would be the case if contact were made at one end of the joint much earlier than the other.

(Automatic hydrogen welding and brazing and silver soldering of stainless steel will be discussed in the final installment of Mr. Whitmer's article, next month.)

A. S. T. M. discusses
testing by

Radiography—Impact—Fatigue

★ Dr. Lester's paper claims radiography is most generally practical method of non-destructive testing—Impact testing helps to develop tougher steels

WHILE THERE IS no single factor by which to judge correctly the significance and success of the 1938 annual meeting of the American Society for Testing Materials, there are certain items which do indicate pretty clearly the activity of A. S. T. M. in its work involving standardization and research in the field of engineering materials.

At the forty-first A. S. T. M. annual meeting over 100 technical papers and reports were presented. In addition to the some 72 new tentative standards approved, 33 existing tentative specifications were approved for reference to letter ballot of the society membership for adoption as formal standards, revisions in 64 tentative specifications were approved and a number of changes in formal standards and proposed changes were developed. Some 38 specifications were withdrawn for various reasons, in most cases because of consolidation with other standards or replacements. If the various recommendations are approved by letter ballot during the summer, the total number of A. S. T. M. standards will approximate 860.

T. G. Delbridge, manager, Research and Development Dept., The Atlantic Refining Co., Philadelphia, Pa., succeeded A. E. White as president; W. M. Barr, chief chemist and metallurgist, Union Pacific Railroad Co., Omaha, Nebr., was chosen vice-president to serve with H. H. Morgan, manager, Rail and Track Fastenings Dept., Robert W. Hunt Co., who became vice-president in 1937.

Radiography Session

In the session of the annual meeting devoted to radiography there were four technical papers in addition to the report of Committee E-7 on Radiographic Testing, presented by the chairman, Dr. H. H. Lester. The opening paper also by Doctor Lester discussed radiography in industry. He pointed out that radiography is widely used and that not withstanding certain misunderstanding and some incorrect applications in the work, especially in the early years, it has become so important in industry that the A. S. T. M., the first industrial society to recognize it, has set up a new standing committee devoted to its interests. He pointed out that radiography is not merely a method of testing. It is a device that makes possible the utilization of more economical methods of fabrication of highly responsible structures. More important than that, it fills an essential need in industrial evolution in that it makes possible the reasonable assurance of dependable service in the structural units of our modern mechanized society. Up to now, radiography remains as the most generally practical method of non-destructive testing. It is the mandate of Committee E-7 to assist in making this powerful tool most fruitful in its service to industry.

Dr. H. E. Seemann of the Kodak Research Laboratories, discussed a problem which is very important in radiography, namely, the effect of secondary radiation upon the quality of a radiograph. He also covered the principles of measurement and results of experiments to determine the amount of secondary radiation in the radiography of common industrial materials. Thicknesses were limited to those which can be conveniently radiographed without fluorescent intensifying screens. The principal conclusions to be drawn are: (1) That lead screens may remove nearly one-half of the secondary radiation recorded when no screens are used, and (2) that no important reduction in secondary radiation is possible by adjustment of the kilo-voltage within the range it is necessary to use for a given subject. The experiment must be considered as a mere introduction to the study of this important problem in radiography, the author states, and that further investigation is contemplated with the hope that future results may contribute not only to our knowledge of the subject but to improvements in radiographic technique.

A study undertaken to refine the accuracy and lower the cost of testing welds (and other objects of like importance) radiographically was discussed by Messrs. Doan and Shang-Shoa Young of Lehigh University.

The authors pointed out that in testing welds radiographically for internal flaws such as cracks, gas bubbles, slag, and lack of fusion, very sensitive methods must be used, or these flaws will be missed because of their small size. Large castings, on the contrary, usually have flaws of a type more readily detected.

A formula has been developed by one of the authors by which it might be possible to calculate exactly the minimum distance permissible from radiant source to recording film in radiographic testing. Such a formula would promise sharp registry of all flaws of important size and at a minimum of exposure time. Results obtained by the authors indicate that dependable registry may be obtained from the penumbral shadow and that the formula for this makes possible a calculation of the minimum distance permissible in obtaining certain registry.

Gamma Ray Testing

In a paper on "A Study of Intensifying Screens for Gamma-Ray Radiography," Messrs. Briggs and Gezelius pointed out it has been known for many years that a reduction in exposure time in gamma-ray radiography can be obtained if materials which fluoresce upon exposure to the rays are kept in intimate contact with the film during the exposure. Calcium tungstate has been found to be the most efficient intensifier for both x-rays and gamma-rays. However, tests made at the time the original studies on gamma-ray technique were conducted indicated that the calcium tungstate screens available at that time did not possess enough advantages, when compared to lead screens, to warrant their use.

Since that time there has been considerable improvement in the calcium tungstate screens available for radiography. It was deemed advisable to study several commercial screens in an attempt to improve the technique now used in gamma-ray radiography. Six different sets of intensifying screens were obtained for the work. The authors concluded that calcium-tungstate intensifying screens show considerable variations among themselves. Each screen studied had different characteristics. The sensitivity recorded by using the calcium-tungstate screens was inferior to that of the lead-foil screens. Also, the longer the exposure the poorer the definition due to the fogging or clouding over the defects by the fluoroscopic effect retained by the screens.

As calcium-tungstate screens are limited to comparatively short gamma-ray exposures on thin sections, and the wave length of the gamma-ray makes it unsuitable for use on thin sections, it appears that these screens are at the present time useful only in cases where good sensitivity and contrast are not required.

Impact Testing

Of outstanding interest to a large number of the engineers at the annual A. S. T. M. meeting was the Symposium on Impact Testing comprising eight technical papers with extensive discussion. This symposium was developed by W. W. Werring, Bell Telephone Laboratories, Inc., chairman of the Section on Impact Testing and Professor M. F. Sayre of Union College, representing the Welding Research Committe on the Engineering Foundation.

Two sessions were devoted to the symposium. In the afternoon session present fields of commercial use for the impact test were stressed, with particular reference to places where the impact test gives necessary information not supplied by static tests. In the evening session, the basic theory underlying impact testing was under discussion. Intentionally, all discussion of the relative merits of specific specimens of the differing types of impact machines now in use was suppressed in favor of the other two questions mentioned.

G. C. Riegel and F. F. Vaughn, Caterpillar Tractor Co., reported upon the success which their company has had in reducing the failures of gears, caterpillar tracks and other parts over a period of years through the development of steels of progressively higher and higher impact strength values, the shape of the parts themselves and the ultimate strength, hardness and ductility of the material used being retained essentially unchanged. The impact test was here used not only as a measure of the resistance of the metal to sudden blows, but also to measure the likelihood of brittle failure under normal static loading at notches or points of stress concentration.

To check on possibilities of added brittleness under severe winter conditions, occasional tests at very low temperatures are made. Occasionally, where ordinary tests leave doubts as to the acceptability of a material, supplementary impact tests on double width specimens with intensified notch effects are made. If the foot-pound values of the double specimens are less than double that of the single-width specimens, the heat is not accepted.

In the evening session the outstanding paper was one by D. J. McAdam, Jr., and R. W. Clyne on "The Theory of Impact Testing: Influence of Temperature, Velocity of Deformation and Form and Size of Specimen on Work of Deformation." This paper emphasized the fact that notch impact testing was primarily a method of testing for potential brittleness in a material under all types of service, rather than a method of testing for resistance to effect of sudden blows, the notch acting to intensify any tendency toward brittleness which might be present in the same way as would lowered temperature or to a lesser degree, higher velocity of blow.

A new apparatus by which the momentary stresses and strains could be measured in a test bar of steel, while being suddenly broken in tension was described by D. S. Clark and G. Datwyler, California Institute of Technology, and some experimental results were given, showing that the strength is generally greater than under slow loading with wide variations in the ratio between the energies required to produce rupture under slow and fast loading.

A critical review of literature on impact tests of welds was summarized by W. Spraragen and G. E. Claussen of the Welding Research Committee. S. L. Hoyt gave an important summary of impact testing developments emphasizing particularly our increasing knowledge of the subject.

(Report on Fatigue Testing and Effect of Temperature on Physical Properties of Metals will be published next month.)

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The Edward G. Budd Mfg. Co. has received an order for 50 light-weight stainless steel motor freight semi-trailers from Horton Motor Lines, Inc. The order for 50 new units will increase the Horton fleet of stainless steel trailers to 66. Sixteen Budd semi-trailers have been in Horton service almost 12 months. These trailers will operate from Charlotte, N. C., to New York City, Atlanta, Ga., and other eastern cities.

The trailers will be 30 ft. long with a height of 11 ft. 8 in. Weight of each unit completed will be 6,300 lbs. with a space capacity of 1,600 cu. ft., or only 3.94 lbs. per cu. ft. of payload space. Bodies and integral frames will be constructed completely of stainless steel. The saving in net weight in the construction of this type of trailer amounts to approximately 3,000 lbs. as against standard construction.

Welding a test specimen in the Armco Research Laboratories, Middletown, Ohio.

Fifth of a series

of practical articles on

Technique of Arc Welding

★ How to handle the electrode when making vertical butt welds and corner welds —Distinction between "all-position" electrodes and "general-purpose" electrodes

By ROY OWENS

Welding Instructor, Electro-Motive Corp., LaGrange, Ill.

SKETCH 28 shows a vertical butt weld made from the top down and is used mostly on light gauge metals from 3/16 in. to 20 gauge with good results. These thicknesses do not require any beveling or veeing, but 12 gauge metals and heavier should be separated one-half material thickness to insure better penetration. When welding 14 gauge and lighter metals, they should be fitted closely to prevent burning through. These light gauge metals are also more affected by the heat and are more difficult to hold in place, therefore, before starting the final welding it should be assembled and tack welded every few inches, depending on the thickness of metal to be welded. The thinner the material the more often the tack weld should be placed to prevent metal from warping or overlapping along the seam to be welded. A general-purpose electrode will give best results, whereas if an all-position electrode is used on the lighter gauge metals, trouble may occur in burning through materials and they will be very difficult to repair.

The sizes of electrodes and heats recommended for welds of this kind are as follows: 1/16 in. electrode for 20 gauge metal using 70 volts on open circuit and 40 to 60 amp.; 3/32 in. electrode for 16 to 18 gauge using 75 to 80 volts and 60 to 85 amp.; ⅛ in. electrode for 8 to 15 gauge using 80 volts and 85 to 140 amp.; 5/32 in. electrode for anything heavier than 8 gauge using 85 volts and 140 to 200 amp. A larger size electrode can be used but not with equal success. Welds made from top down will have a very thin metal deposit as the arc is carried down fast to keep ahead of the molten metal and slag. Hence less metal will be deposited. If the electrode is carried at a downward slant of about 60 deg. from the vertical plate and ahead of the weld, the deposit will be heavier and less trouble will be encountered with molten metal and slag flowing ahead of the arc, because the arc blast will tend to hold it back.

If the electrode is held at a 90-deg. angle as indicated by dotted lines in Fig. 28 a wider and thinner weld will result, also interference may be expected with molten metal and slag flowing ahead of the arc, which will make a good weld almost impossible. If an arc of excess length is used the same poor results will be obtained.

Figure 29 shows a weld on the outside corner welded from the top down. The two pieces are placed so that they come together inside corner to inside corner and form a 90-deg. vee on the outside corner which is desirable on welds that are to be made in one pass. Good penetration will be comparatively easy and the outside will fill out to a rounded corner that will require very little grinding to make it appear as if it had been formed in a bending brake.

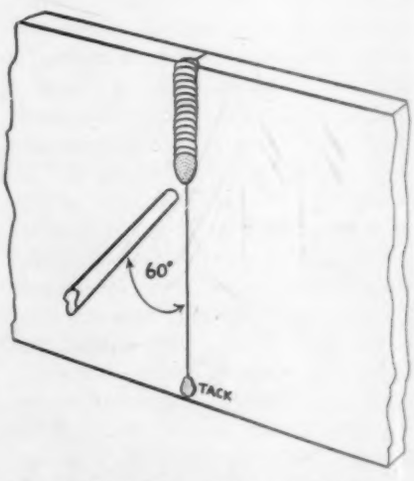

Fig. 28—Making a vertical butt weld from the top down (light gauge metal).

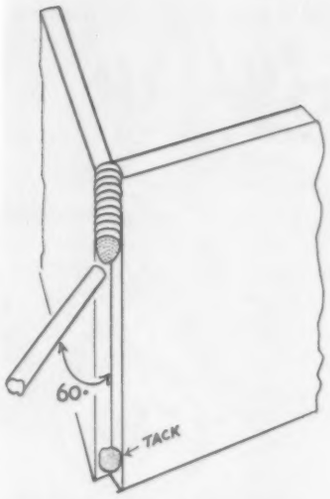

Fig. 29—Making a vertical outside corner weld, working down from the top.

Welds of this type can be made faster, as little or no side motion will be necessary and they are recommended for any thickness up to and including 3/16 in. Welds of this kind should be welded from the top down instead of from the bottom up because twice as much time will be required to do the same job going up and the welder will find it difficult to keep from burning through light metals. Since more time is spent going up the heat will be radiated out into the parent metals and more distortion will result. The bead will be lumpy and irregular. The electrode should be carried at the 60 deg. angle as previously shown in Fig. 28 and a short arc should be maintained.

All-Position Electrodes

If an all-position electrode is used good penetration will be obtained, but insufficient build-up may result. At this point it will be well to explain some of the characteristics of the all-position and general-purpose electrodes. An all-position electrode is more commonly used on reverse polarity and where maximum penetration is required. These electrodes melt slower than other electrodes, therefore, more time is spent on the parent metal and less electrode is melted as filler metal. Since this electrode does not flow as fast as some of the other types it is ideal for vertical and overhead welding. This type electrode is often referred to as a "hot" electrode on account of its penetrating quality and its use in all positions. The wire used in making this type electrode will vary only slightly in analysis from the other types, the difference being due to the coating on the electrode.

General-Purpose Electrodes

The general-purpose electrode can be used in most cases on either straight or reversed polarity and on a-c. or d-c. current, but will flow faster on straight polarity. Some electrode manufacturers recommend straight polarity for downhand or fillet welds and reverse polarity for vertical and overhead with the general-purpose electrode. This electrode is recommended where poor fits and large openings are to be welded and is commonly used in production shops; it will give average penetration at a much greater speed of travel; it will flow out with heavy heats; it has a neat appearing bead, but if insufficient heat is used there will be poor penetration and excess build-up. An electrode of this kind is often referred to as a "fifty-fifty" electrode which means that it isn't the fastest flowing electrode on the market, nor the slowest, but a medium flowing electrode.

Figure 30 shows a weld made from the top down on heavy material as a first pass only. The second pass is welded from the bottom up to finish the job. The advantage in running the first pass down is that the plates are Veed from one side and are very thin where they come together. The slight opening between pieces (as indicated by arrow) makes it difficult to put in a stringer weld from the bottom up without burning through. To overcome this fault the weld is put in from the top down using a small size electrode with maximum heat. The electrode is carried down sufficiently fast not to allow holes to be burned through. While a thin weld will result, it will seal the opening between the pieces and will fill in the smaller part of the V so that a large electrode can be used for the second pass without encountering trouble with non-fusion at the bottom of the V.

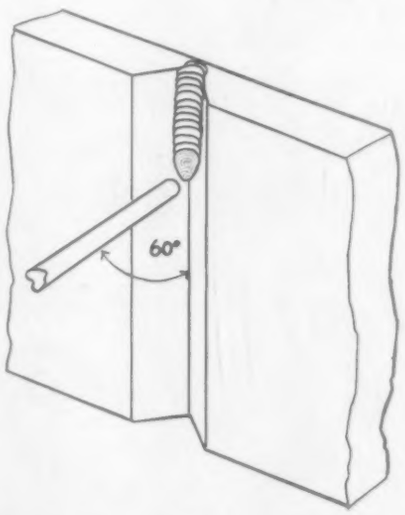

Fig. 30—Making the first vertical pass on a vee'd butt weld in heavy plates.

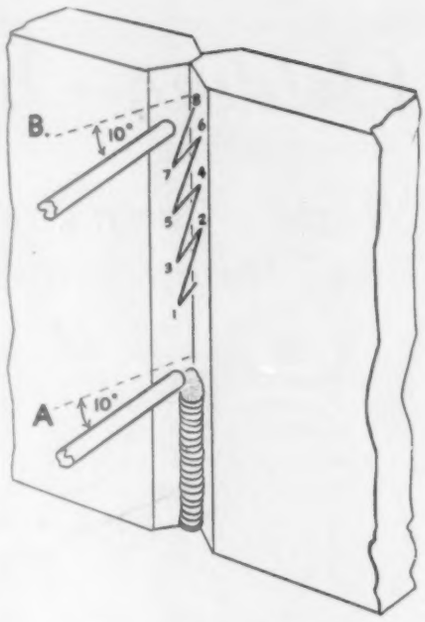

Fig. 31—Two methods of running a stringer weld in a double vee'd vertical butt joint.

Vertical Stringer Welds

Figure 31 gives an illustration of a case where a stringer weld running vertically will be more effective for good penetration as the two pieces are fitted closely and have a heavy section between the Vee's (as indicated by arrow). Figure 31 also shows two methods of making welds of the stringer type. The electrode *A* at the bottom has no motion except the steady upward motion as the filler metal builds up below the arc and then only slightly ahead of the filling in order to burn into the bottom of the V as far as possible. The outer appearance of this weld is not important as the second pass will be put in later and will completely cover the first pass. Electrode *B* shows an oscillating motion which can be used and will give approximately the same results as electrode *A*. It is optional with the welder which type weld is used, as both are satisfactory. In each example the electrode is tilted 10 deg. down from the horizontal and in back of weld in order to keep the arc burning into the parent metal. As the parent metal and electrode liquify, they will flow down out of the arc and solidify.

(Sixth article in Mr. Owen's series will appear next month—Editor.)

Welding—Major Tool of Industry

World's Largest All-Welded Steel Dump Scows

★ Two of the largest all-welded steel dump scows ever to be built in an inland waterways shipyard have just been launched by the Dravo Corp., at its Neville Island yards for use on the Great Lakes. Both dump scows were built for Merritt-Chapman & Scott Corp., New York City, in record time, and will be used on Lake Erie at Conneaut, Ohio.

The scows have a capacity of 1,200 cu. yds. and measure 206 ft. by 40 ft. by 14 ft. Over 650 tons of steel were required for fabrication of each vessel. Original plans for the scows were based on riveted construction. However, Dravo engineers realized that an all-welded construction would lead to an increased efficiency in the use of the steel required, would result in a general over-all decrease in weight, and would provide considerable cost saving. For these reasons, the plans were re-drawn and the barges were built by welding.

Each scow contains nine hopper pockets, 17 ft. long, 25 ft. wide at the top, and 13 ft. wide at the bottom. The pockets are equipped with two hopper doors built of composite timber and steel, using heavy oak timber fills between 10-in. and 12-in. I beams. Hopper bulk head fenders and coaming fenders on the loading side of the scow are concrete filled. The hopper doors are operated by a 6-in. by 6-in. throttle reversing steam engine, the engine being connected to a ratchet arrangement on a steel jack shaft. Steam is provided by the towing tug. The ratchets, in turn, revolve a gate operating shaft and are so arranged as to permit the independent opening and closing of the hopper gates.

Solid weld power shovel chains run from the gate operating shaft to double cable slings, which pass through guide castings to the doors (Fig. 2). Chains are tested to a breaking strength of 175,000 lbs. Release of a pawl opens the doors by gravity and the weight of the load.

At each hopper separation, water-tight bulk head divisions are provided throughout the length of the scows, forming individual buoyancy tanks. One 16 in. by 20 in. manhole is provided for each water-tight compartment. Both rake ends contain separate water-tight rooms for storage of lines and equipment. These rooms measure 6 ft. by 10 ft. and are placed on the operating side of the vessel. Fully loaded, the scows will draw about 12 ft. 6 in. of water.

Fig. 1—Hopper door operating mechanism works through medium of shafts and power chains.

Fig. 2—Interior of one hopper pocket, showing double cable slings for operating hopper doors.

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New Radiant Tube Bell Type Furnace

★ A radiant tube bell type spheroidizing furnace, manufactured by Surface Combustion Co., Toledo, Ohio, makes it possible to spheroidize SAE 3135 and SAE 1335 rod with practically no scale nor decarburization according to the company. This work is reported possible without the use of a special atmosphere.

This furnace utilizes a special type of arc welded construction which makes it impossible for air or any of the products of combusion to come into contact with the work. The gas is burned inside of the radiant tube heating elements. The air infiltration is effectively prevented by the use of a double sand seal and by the leakproof arc welded seams.

In operation the coils of wire or rod to be spheroidized are loaded on a spindle and transferred to a stationary base. Thermo-couples are tied in position after which a light steel or alloy inner cover is placed over the

Radiant tube bell type furnace which spheroidizes with practically no scale or decarburization.

loaded spindles and sealed in sand. A radiant tube heating cover is then lowered over the inner cover and also sealed in sand. Gas, air and electric connections are made and the work heated up to temperature. After soaking, the hot radiant tube cover is transferred to another base and the heated work allowed to cool under the inner cover, being protected from the air by the sand seal. A complete cycle of change takes only 3 to 5 min. Thus, the heat loss is small when transferring the cover from one base to another.

Where a bright surface is required, this furnace is suited for use with DX atmosphere gas. The furnace may also be used for annealing and normalizing in addition to spheroidizing. The welded construction, which was done by the Lincoln shielded-arc process, can be seen under the radiant tube heating cover in the illustration.

» «

How to Rebuild Cutting Edge of Worn Dipper Teeth

By F. J. HIRNER*

★ Here is a simple and low-cost way of building up worn dipper lips and teeth right in the field—saving the expense of buying new parts and cutting down time lost. Practically all power shovel and dragline buckets are equipped with lips and teeth made out of some type of manganese wear-resisting steels. Thus, in building up manganese steel sections, it is advisable to use a coated electrode having manganese steel properties similar to those of Smootharc "Harmang."

*With Harnischfeger Corp., Milwaukee, Wis.

While this data applies specifically for use with "Smootharc "Harmang," it would apply to any electrode having approximately the following chemical analysis:

Manganese	11% to 14%
Nickel	3½% to 4½%
Carbon	Approximately 1%

This alloy has distinct physical properties which render it particularly valuable for use on operations imposing combined abrasive wear and excessive impact or shock. This electrode is not to be confused with the 5 to 10% manganese types which ordinarily produce a brittle weld unfit for this application. "Harmang" is effective because it is a coated type manganese electrode. This light coating stabilizes the arc and protects the metal against loss of carbon and manganese. However, the slag volume is kept at a minimum so as not to interfere with rapid cooling which is essential to the formation of an austenitic deposit.

In the "as-welded" state this high manganese deposit is soft and ductile, but cold working such as hammering, peening, etc., decomposes the soft austenite to extremely hard martensite, and when once formed, this martensitic layer offers resistance to impact and abrasion.

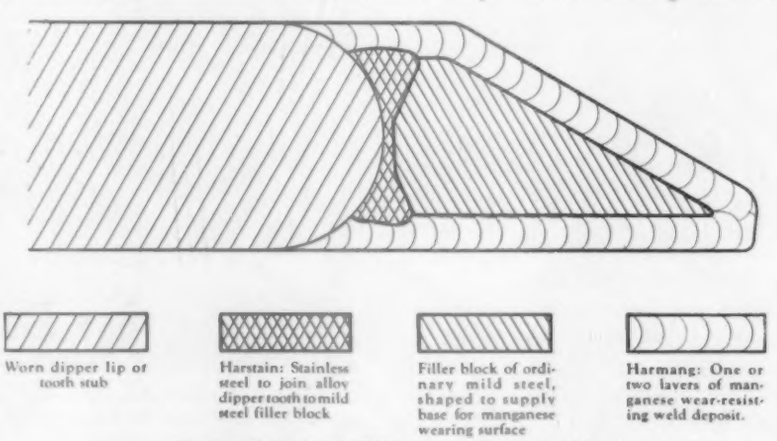
Welding Procedure: Use reverse polarity (electrode positive; work negative). A medium length arc is recommended (24 to 26 volts) and the following currents:

Size	*Amperes*
1/8 in.	6-100
5/32 in.	90-150
3/16 in.	120-200
¼ in.	170-260

These welding currents are general and should be adjusted in accordance with the particular application and the type of electrode used. Flatter beads and greater penetration are produced with the high heats, although care should be taken to avoid the use of excessive welding heat.

Laying the Bead: The manganese steel surface to be built up should be divided into areas approximately 1½ in. square, and the amount of metal deposited at one time should be confined to this area. A rather wide bead, applied in a semi-circular motion is recommended. But no more than 3/16 in. thickness should be deposited at one time.

Vigorous peening of the hot bead with an air or hand hammer is essential to relieve shrinkage stresses, and to increase surface hardness. While the deposit should be hammered smooth, it is important not to do this peening to excess—that is to a point where the metal starts to flake—indicating that the deposit has reached the point of brittleness. The diagram below shows how the weld metal should be applied. Study the sketch carefully before starting the work.


Worn dipper lip or tooth stub
Harstain: Stainless steel to join alloy dipper tooth to mild steel filler block
Filler block of ordinary mild steel, shaped to supply base for manganese wearing surface
Harmang: One or two layers of manganese wear-resisting weld deposit.

One method of rebuilding worn dipper teeth.

Timing Case Repair Made by Bronze Welding

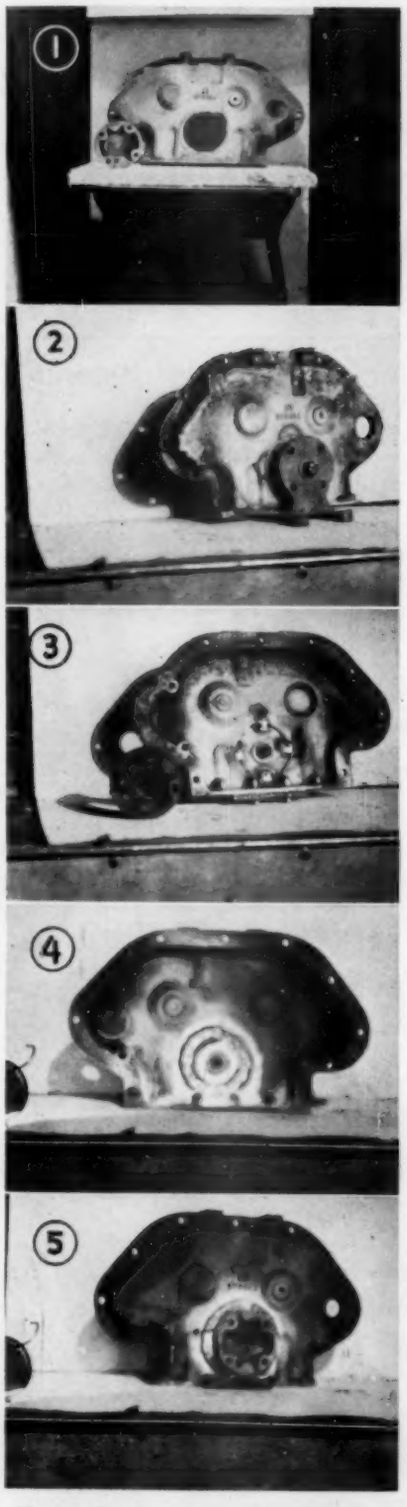
By A. F. MORTON

★ Figures 1 to 5 show a step-by-step method of repairing the timing case and front motor support of an Autocar truck. Here is why we call this a successful repair job. During the last three years about 25 timing cases have broken the same way and have been repaired as outlined herein. None of these bronze welded cases have been returned. After such a length of time in service we feel safe in saying that the method of repair is satisfactory.

These cases come to the shop broken, although no fault can be found with the part. Wear alone, we think, is the cause of failure. The hub of the case wears in service around its lower circumference. When enough wear has taken place, it is only a question of time until the truck hits a big hole or bump. Then the up-and-down play between the hub and the yoke, into which the hub rides, causes the hub to be sheared off.

Figure 3 shows, in addition to the timing case, a spare hub, which is also worn egg-shaped. In fact all of the hubs are worn the same way in the center hole, through which the end of the crankshaft extends. The first step in repairing is to fill this hole with cast iron. After cooling the casting over night in the scrap asbestos bin, it goes to the machinist who drills a center hole large enough to take the centering bolt, of the jig, shown in Fig. 2. The machinist also takes a 45-deg. cut off of the hub on the side which goes next to the face of the timing case. The broken hole in the timing case, into which the hub fits, is also ground off for the purpose of increasing the space between the hub and case so that the bronze will run through to the underside. When the case is turned over, it is easy to pick up the bronze and make a sound bronze weld from one side to the other.

When the hub and case are prepared as stated, the parts are bolted together and held in place by the fixture as shown in Fig. 2. Next the hub is tacked in position on the inside as shown in Fig. 3. Then the fixture or jig is removed and the pieces are put



Figures 1 to 5 inclusive show step-by-step procedure in repair of broken timing case—Text references keyed to figure numbers above.

in the sand blast cabinet and steel grit blasted on both sides giving a clean rough surface to work on. The case is then given a slight amount of preheating, enough to make cold water drops "dance" on its hot surface. Next the case is removed from the stove and mounted on a tripod to which a bolt has been welded. This bolt extends through the hole in the hub. The case is then welded around the outside of the hub first, removed from the tripod, laid hub down on the welder's bench and completed from the inside as shown in Figs. 4 and 5.

We recommend using No. 4 and 5 welding tip and a bronze rod and flux especially developed for cast-iron brazing. With a torch in good condition and a pair of regulators which will maintain a non-fluctuating flame, there is hardly any excuse for failure to get the results desired. Other methods of doing this job, such as arc welding without preheating were given a trial, as well as preheating and gas welding with a cast-iron rod. Both methods were discarded. Bronze beat them both on welding speed, ease of machining, and minimum warpage.

When the welder is through, the machinist bores out the center hole to the correct size, turns off the face and inside, turns off the outer circumference of the hub to take a shrink-fitted piece of tubing and the job goes back on the truck. Possibly, all of this work would not pay out on an individual repair job, but with the number of these jobs we have, it is worth while to make the jigs and fixtures.

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Boiler Fabrication with A-C. Welders

★ Speed of operation has gone up while maintenance and power costs have gone down in the Geneva, N. Y., division of the Burnham Boiler Corporation, manufacturer of low-pressure heating boilers. These results were brought about by two major programs: first, the substitution of equipment that was best suited for the work; second, improved production control and similar foresighted changes. The benefits obtained paid for the new equipment in eight months it is claimed.

About three years ago, General Electric a-c. transformer-type weld-

Fabricating boiler in Burnham Boiler Corp. shop in Geneva, N. Y.—Welding with a-c. arc.

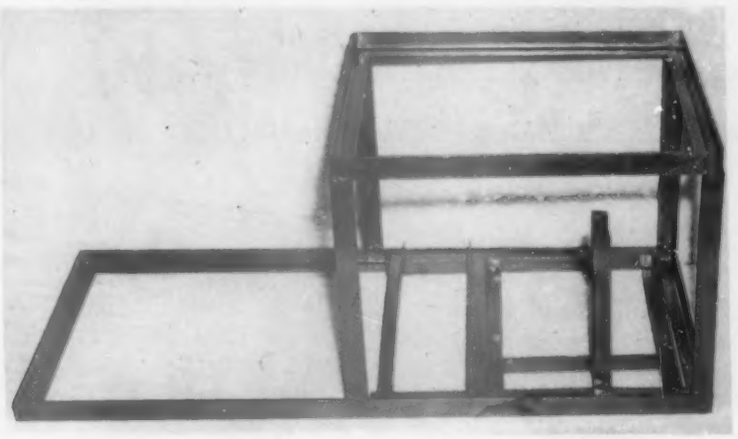
ers, including two 500-amp. units, were installed. Records kept since the a-c. equipment was purchased show a 75 per cent reduction in cost per foot of weld. It is claimed that the factors in this reduction are a 60 per cent decrease in welding time per boiler, a 35 per cent cut in the amount of electrodes used, and a 70 per cent lowering of power and maintenance costs. With the elimination of "magnetic blow" by use of alternating current, operators are able to work in boiler corners more accurately and easily.

» «

Welded Power Chair for Invalids

★ A welder with about 20 years experience in a job welding shop conceived the idea of building a welded invalid chair which could travel at a speed up to 10 miles per hour, deriving power from a storage battery. He kept working on the idea until he developed the type of chair shown in the illustration. The inventor is Geo. B. Julian, of the Chicago Power Chair Co., 2248 Ogden Ave., Chicago.

The main frame contains 21 arc welds and is fabricated of 3/16 in. x 1¼ in. angle iron. Within the main frame and under the seat, there is an angle iron sub-frame containing 14 arc welds. This sub-frame is made of ⅛ in. x ¾ in. angle iron. The driving

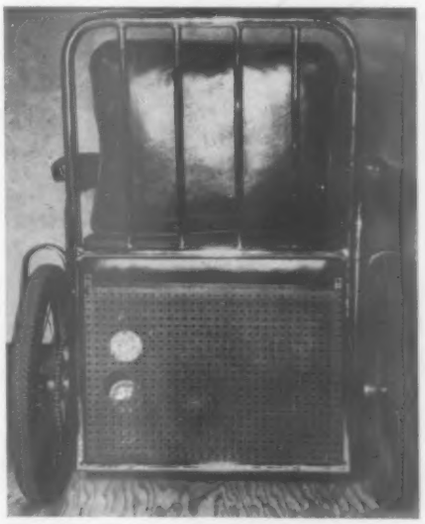


Arc welded angle-iron frame of power chair—Sub-frame at lower right fits inside of main frame.

Side view of power-operated invalid chair.

motor, storage battery, control rheostat, and charging apparatus are mounted on the sub-frame. A chain and sprocket drive is employed to convey driving power to the left rear wheel, which is equipped with a bicycle coaster brake to give "free wheeling."

It will be seen from the illustration of the rear of the chair that the frame is fabricated of welded seamless tubing, the main frame being of 1 in. tubing, the vertical braces of ⅝ in. seamless tubing. Mr. Julian used a Torchweld oxy-acetylene torch in welding the 12 joints in the steel tubing. Manganese bronze rod was used in welding the tubing.



Rear view of invalid chair showing frame made of welded seamless tubing—A total of 12 gas-welded joints.

» «

Welding the giant Phoenix which will catch the eye of the visitors at the 1939 Golden Gate Exposition.

» «

A 15,000,000 CU. FT. NATURAL GASOLINE plant, employing considerable welding in its construction, will soon be erected by the Continental Oil Co., in the Kemp-Manger-Allen oil field, in North Texas.

High-Speed Repair Service Featured By Denver Job Welder

By ROBERT LATIMER

★ A high-speed, guaranteed-repair service is bringing excellent results for the Smith Welding Co., Denver, Colo. With construction and contracting work rising steadily in Colorado, particularly in the mountain districts, the company has been advertising unusually swift repair service, and is backing up its claim with some good examples of work turned out under pressure of time.

The most recent welding accomplishment was the repair of two 2½-yd. dipper sticks, for J. B. Burtrand & Co., Denver contractors. Both of the power shovels operated by this firm were moving rocky earth for a new roadbed east of Denver, when both dipper sticks snapped off just above the dipper. Faced with losing considerable time and money while the shovels were inactive, the dipper sticks were loaded on trucks and rushed into the Smith welding shop.

The broken end plates were immediately heated, and the side plates cut out for 18 in. Heavy ⅝-in. reinforcing straps were welded in, on all four sides of the beam, and the original plates beveled back in, and rewelded over the reinforcements. Because both dipper sticks had snapped at the same point, it was possible to save a great deal of time in handling them simultaneously, and they were back in service in two days.

Advertising this type of service to the Midwest Steel Co. of Denver produced results almost immediately. This firm operates a battery of heavy steel punches, and manufactures all types of construction steel girders and beams. Recently, the main punch, used for punching rivet-holes and beam-end connections in girders, overstepped its guard, and broke the punch-stage entirely off the base of the machine. The Midwest Co. at that time was busy getting out an order which required the use of this punch every minute, and an emergency call was sent out to the Smith Welding Co. This job was done on the spot. A portable oxy-acetylene outfit was used, clamping the stage back into place, and brazing it. Much difficulty had been anticipated with the jagged line of the crack where the punch-stage had come away, but careful treatment with the torch produced a 100% effective job. The punch was back in service after 10 hrs. of work.

Not only repairs, but "custom-made" accessories are turned out by the Smith plant. A good example is the equipment built especially for the Colorado highway maintenance department. Early spring snows, followed by heavier and unsuspected storms in the mountain territory caught the department flat-footed, and forced the closing of roads ordinarily open from April to later winter. Highway officials sent out a rush call for a 1½-yd. dragline snow bucket to clear the ditches, most of which were ice-bound. Smith produced in 3 days an efficient snow bucket of ⅜-in. steel plate, with a tempered lip cutting edge. This bucket is being operated with a power shovel and crane boom. No bolts are used in the entire shell, all of it being welded. Much favorable business has come the way of the Smith Co. as a result of the publicity on this job.

"Weld-Remodeling," although a coined term, is a good description of the newest service offered by the Smith Co. The most outstanding service in this category was performed for the Broderick & Gordon Construction Co., who were putting through a water-main tunnel for Denver, west of the city, in the lower Rockies. Two hundred and fifty H-beam arches, made of 5-in. girders, were ordered from an eastern fabricator, and after delivery, were found to be one foot short, and not wide enough to form tunnel supports. The Smith Co. tackled this huge order with all the facilities they could muster, and welded a 12-in. leg on one piece of each arch, and a 10-in. extension on the apex. This made the arch 10 in. wider and 12 in. longer, enough to meet the specifications of the contract.

To maintain this service, Howard Reynolds, the manager, keeps three portable outfits ready for instant service, and has a crew of 7 regular welders qualified for quick diagnosis of a repair job, and speedy repair. Advertising is done by means of newspaper, contractor's listings, and telephone book classified space.

» «

Convenient Welding Rod Stand

★ An all-welded homemade stand for keeping various kinds and sizes of welding rods separated and in their proper place in the job shop, is shown in the accompanying photograph which came to us from a little town in Southern California. The base for the stand is a flywheel from an old truck, 18 in. in diameter. To the base is welded a piece of 3-in. pipe which supports the sections of pipe making up the rod containers. The top of the upright supporting piece of pipe is cut out in crescent shape into which is fitted and welded the first section of the stand. To this, as were needed and desired, other sections of pipe were laid alongside, or above, and welded, thus increasing the size until the stand was completed as shown. Pieces of steel plate were cut to circular shape and welded to the sections of pipe at the back ends. This convenient piece of shop equipment was made by Adolph Kasparek, welding shop owner, in Azusa, Calif.

Welded stand for keeping welding rods in order and conveniently accessible.

New Product Developments

M.S.A. Coated Cover Glass

★ Immunity to pitting and resistance to heat, plus clarified vision and ability to outlast ordinary glass 10 to 50 times, are a few of the advantages claimed for M.S.A. coated cover glass, as manufactured by the Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.

Widely used in welding and cutting operations, M.S.A. coated cover glass increases working efficiency and provides positive protection against molten sparks fusing to its surface, thereby obviating blurred vision, eye-strain and resultant inferior work. The new product insulates the shaded welding lens against heat, and reduces costs by eliminating the need for frequent replacement.

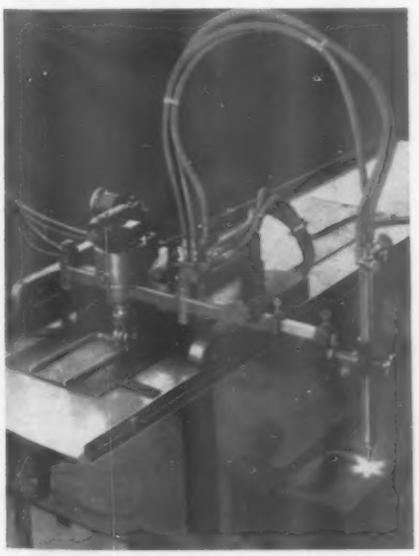
Copies of a newly published bulletin describing the M.S.A. coated cover glass in complete detail, are available by writing direct to the manufacturer.

» «

Portable Oxy-Acetylene Cutting Machine

★ The Linde Air Products Co., Unit of Union Carbide and Carbon Corp., announces the Oxweld (Type CM-15) portable shape-cutting machine, the latest addition to its line of portable cutting machines. This new machine fills a definite place in the range of sizes from the smallest portable machine to the large stationary machine and does not displace any of the other Oxweld cutting machines now on the market.

The CM-15 combines many of the desirable features of both portable and stationary cutting machines. The machine weighs less than 200 lb. complete. All controls of the machine are conveniently located adjacent to one another. The cutting area—the maximum range of blowpipe movement—is 60 in. lengthwise and 18 in. laterally. Cutting speed can be varied from 3½ to 28 in. per min., and a speedometer indicates movement directly in inches per minute. Accurate results can be obtained within the operating limits of the machine because of its precise construction.



Accurate cutting of any number of similar shapes is possible with the templet tracing attachment for the Oxweld CM-15 portable shape-cutting machine.

Templet-tracing, hand-tracing, automatic circle-cutting, and straight-line cutting are all within the scope of operation of this machine. Any desired shape within the range of the machine can be automatically cut by the use of templets. A straight-line cutting guide is used for straight-line cutting in any direction. Circles from 2 in. to 18 in. in diameter are cut by the use of the circle-cutting attachment. Hand-tracing is accomplished by guiding the tracing wheel over a blueprint or drawing. Bevel-cutting up to an angle of 45 deg. can be done in either direction by merely shifting the angle of the blowpipe. In addition, a supplementary blowpipe bar, which is furnished with the machine, permits the use of two blowpipes for simultaneous cutting of similar shapes.

» «

Thermoid Double Weld Hose

★ One of the more recent products perfected by Thermoid Rubber Division of Thermoid Co., Trenton, N. J., is Thermoid Double Weld hose. This hose overcomes the handicaps of hose lines that tangle and twist and generally slow up production.

It contains two equal lengths of specially constructed hose, one with a red cover and one with a green cover, bonded together to form a single unit. For attaching to separated fittings, Double Weld hose may be split into separate hoses for any required distance. Splitting beyond the desired point is prevented by a special clip supplied by Thermoid.

Double Weld hose is designed for welding and cutting equipment. It is just as flexible as ordinary hose, and is carefully built.

» «

Tungsten Molybdenum Electrode for Welding of Tool Steel

★ The Harnischfeger Corp., of Milwaukee, Wis., has introduced a new Smootharc welding electrode—Smootharc "Hartung." With a base metal of high quality tungsten molybdenum wire, this electrode is used for making tool steel cutting edges on medium carbon steel, or for rebuilding worn tools and dies. The analysis of its deposited metal is equal in composition and physical properties to the highest grade of high-speed tool steels on the market. But it has extreme air hardening properties which, without treatment, possess hardness values in excess of 60 Rockwell "C."

Although it is not intended as a substitute for the cemented carbide tool insert, tool points of high hardness can be built up on medium carbon steel bars prepared in the same manner as those used to support tungsten carbide tips. Its use is also recommended where excessive wear and high initial hardness are required. In welding procedure it is used with the work negative and the electrode positive and is available in sizes from 3/32 in. up to ¼ in. in diameter for use with currents ranging from 30 to 256 amp. Further information on this new electrode may be obtained by writing to Harnischfeger Corp., 4400 West National Ave., Milwaukee, Wis.

» «

New Atomic Hydrogen Welding Equipment

★ A new atomic-hydrogen arc-welding equipment, especially suitable for the welding of special alloys and thin sections has been announced by General Electric. The equipment is particularly useful where a fusion weld is required; it produces a uniformly strong weld, free from porosity, and smooth in appearance. Some common specific applications are: the building up of broken or worn sections of molds, tools and dies; the addition of a different metal for hard surfacing and other special requirements; and the welding of light-gauge stainless steel.

Atomic hydrogen welder combines in one unit all of the electric devices used with the process.

In atomic-hydrogen arc welding, an a-c. arc is maintained between two adjustable tungsten electrodes, and at the same time hydrogen gas is fed to the arc and around the electrodes. The hydrogen molecules, subjected to the intense heat of the arc, are broken up into atoms. The majority of these atoms, recombining outside the arc zone, in contact with the work, liberate an intense heat suitable for welding.

The new G-E equipment combines into a compact, portable unit, all the electric devices used with the process. Convenient terminals and pipe fittings allow ready connection to the electrode holder, to the power supply, and to the hydrogen source. A convenient, easily-operated handwheel on top of the set controls a continuously variable reactor which gives stepless current adjustment to any one of an infinite number of settings, thus permitting use of the correct current for every job. An ammeter clearly indicates the amount of current that is being used.

The drip-proof enclosure protects the equipment and the operator. Ventilation is provided by louvres at the ends. Lifting eyes facilitate transportation by crane. Roller-bearing wheels can be added to make the unit even more easily portable. For hand welding, the familiar rod-type electrode holder with suitable power and hydrogen connections is furnished, together with a supply of tungsten electrodes of the correct size.

For automatic welding, equipment with either a single- or multiple-arc head can be supplied, together with the necessary control, means for holding the work, and traveling mechanism. The same power-control unit as that employed for hand welding is applicable to automatic installations. All that is necessary is to supply additional control for the automatic head. A wire-feeding device is furnished where needed.

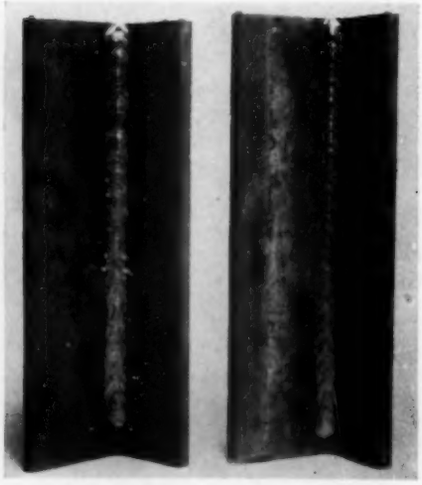
» «

New Compound Facilitates Cleaning After Welding

★ A new compound, which is said to reduce cleaning time after welding by 20 to 60%, is announced by The Lincoln Electric Co., Cleveland, Ohio. This new compound, known as "Spatter Film," has been developed by Lincoln engineers to increase the economy of electric welding as a process of manufacture and fabrication. By reducing the tendency of spatter to adhere tightly, "Spatter Film" makes fabrication by arc welding still more economical. The savings resulting from use of the compound will be particularly apparent in work where painting and finishing are essential.

"Spatter Film" is soluble in water. It is non-inflammable and contains no free alkali to injure the hands nor to harm paint. It is easy to apply by means of an ordinary paint brush. Only sufficient of the film need be applied to cover the work adjacent to the seam or joint. A gallon of "Spatter Film" will cover appropriately 50,000 sq. in. of surface. It can be removed readily for painting by wiping with a clean cloth, if still wet, or by washing it off with water if dry.

"Spatter Film" is sold in quart, gallon and 5-gallon cans, or 55-gallon drums.

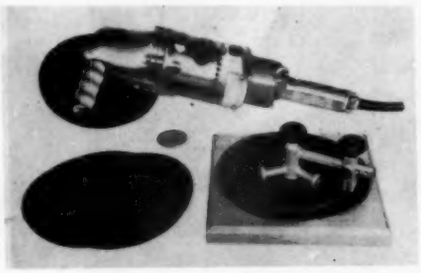


Note difference in weld spatter on two samples—Weld made without "Spatter Film" at left—Weld made with "Spatter Film" at the right.

» «

Two-Speed Electric Sander

★ A versatile two-speed sanding unit, adaptable to use with both 7 in. and 9 in. abrasive discs, has recently been announced by the Van Dorn Electric Tool Co., Towson, Md. Developed to eliminate the necessity of purchasing two tools of different speeds in order to use 7 in. and 9 in. discs, this tool fills a definite need in general sanding operations. As most of the wear on a sanding disc occurs toward the outer edge, it is possible, with this new machine, to get the maximum wear from a 9 in. disc and, by trimming off the worn outer surface, obtain a 7 in. disc that is practically unused. A disc cutter is furnished with each tool.



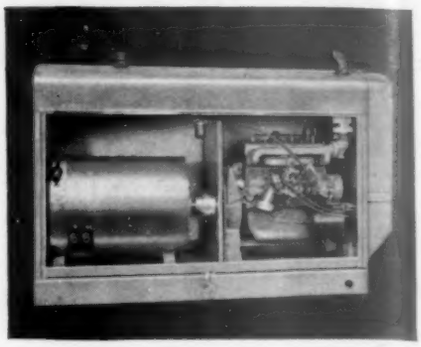
Two-speed sanding unit utilizes discs economically.

The speed adjustment is made by means of a simple gear shift in the gear housing, which alternately engages two different sets of double gears. Armature and intermediate gears are spiral and the spindle gear is spiral-bevel. The unit is equipped with a patented gear locking pin to facilitate interchange of flexible pads and the gear-shifting adjustment. Two moulded pads (7 in. and 9 in.), together with three 9 in. abrasive discs are supplied with each tool. The no-load speed for the 7 in. discs is 4,200 r.p.m.; for 9 in. discs, 2,700 r.p.m. A universal motor, operating on a-c, or d-c., is standard equipment.

» «

200-Amp. "Special" Arc Welder Has Wider Operating Range

★ The new P&H-Hansen 200-amp. "Special" engine-driven arc welder has been built in answer to the demand for an engine-driven welder with a somewhat wider operating range than the average 150-amp. unit. It is stated that the new unit is much lower in price than the standard 200-amp. unit. A 200-amp., 30-volt, 6-kw. generator with an intermittent welding range of 35 amp. to 225 amp. is connected by a flexible coupling to a 24 hp. 4-cylinder, water-cooled Continental gasoline engine. The engine is equipped for hand-starting and with magneto ignition system. Its full tank capacity is 13 gallons.



P. & H. Hansen 200-amp. engine driven arc welder.

The entire unit is mounted on a formed steel base and equipped with a fully enclosing sheet metal canopy having removable sides for easy access to all parts. Although in its standard form the "Special" is a stationary type machine, it can be supplied with the standard P&H two-wheel pneumatic-tire running gear as now used on the P&H 150-amp. portable, engine-driven welder. The "Special" is built to handle electrodes up to 7/32 in. in diameter under continuous manual operation. Equipped with a Continental engine, of the type used on agricultural equipment, it is an easily serviced machine. Further information about this new machine may be obtained by writing to Harnischfeger Corp., 4400 West National Ave., Milwaukee, Wis.

» «

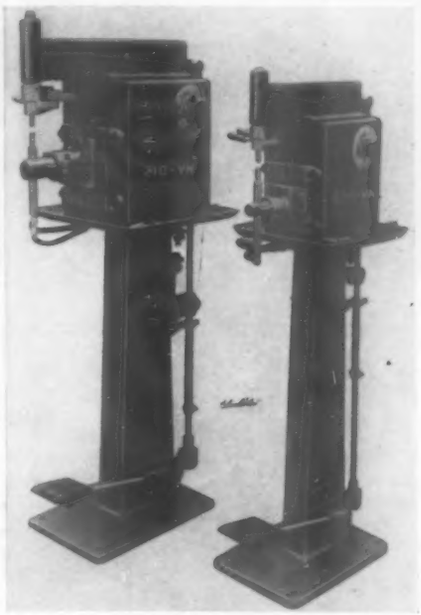
Vertical Type Spot Welders for Precision Work

★ The demand in recent years for precision spot welding in which the fulcrum type spot welder cannot satisfactorily answer the purpose, has led to the development of a complete line of vertical type welding machines by the Eisler Engineering Co., 740 So. 13th St., Newark, N. J. Extreme accuracy in the spot welding of parts used in the manufacture of typewriters, adding machines, clocks, check writers, safety razors, precision toys, etc., is assured by the plunger action of the upper electrode of the vertical machine, and welds of uniform strength result. Where more accurate results are desired, these machines are supplied with timers and contactors.

Ranging in size from 1 to 35 kva., these machines are supplied in foot, air, or power-operated models, depending on the class of service for which they are intended. Either bench or pedestal models are available. The illustration shows two vertical type welders in the smaller size. No. 205-VN is a 5-kva. model, and No. 210-VN is a 10-kva. job.

These machines are especially adaptable where studs and lugs are to be accurately welded to sheet metal without the drilling of holes.

A typical application of the Nos. 205-VN and 210-VN spot welders is their use in welding electrodes to spark-plug shells. It is essential that the welding operation be precisely performed. A suitable fixture together with the vertical action of the upper electrode of the welder accomplishes the desired result.



Two Eisler vertical plunger type spot welding machines.

A standard single-phase welding transformer provides the welding current. Six points of heat regulation are obtainable with the dial control mounted on the side of the case.

» «

New Thomson G Series Power-Driven Spot Welder

★ Some spot welders are essentially foot-operated machines with motor drives added, but the new Thomson G Series welder is designed specifically for power drive. All parts have the necessary bulk and strength to stand up under constant operation in production shops working in sheet metals or stampings.

The G Series welder is available in three standard throat depths and four transformer capacities and has a speed range wide enough to adapt it to the space of any production line. The choice of throat depths is 12, 18 or 24 in. and the transformer capacities are 20, 30, 40 or 60 kva. In each size, the transformer is water cooled to operate continuously at full load without overheating.

The frame is made up of a heavy fabricated steel base with a cast-iron head bolted to it in such a way that welding pressures do not strain the head bolts. Both arms are hard rolled copper, 2½ in. in diameter. The lower arm has a normal drop of 5½ in. or 14¾ in. by reversing the arm holder and it can be swung 30 deg. to either side of the center line.

Thomson G Series Spot Welder.

Pressure is supplied by a cam driven by a worm reduction unit and acting on the rocker arm into which the upper welding arm is clamped. A hardened nut which bears against an anti-friction thrust bearing provides means for regulating the pressure from approximately 200 lbs. minimum to 800 lbs. maximum. Heat regulation is obtained with a five-point regulator.

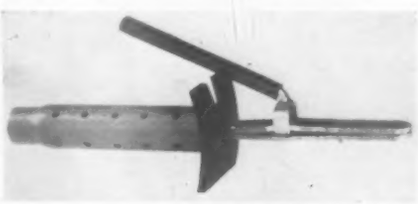
Control of current dwell is provided by a magnetic contactor, limit switch and an adjustable fan-type cam which operates in conjunction with the pressure cam. The drive mechanism is mounted on the head casting and consists of a worm reduction unit and clutch, driven by a ½ hp., 1200 rpm. motor through a pair of three-step vee groove pulleys. The speeds obtainable with the various pulley arrangements are 42, 53, 66, 81, 101 or 127 spots per minute. The overall height of the G Series welder is 53 in., the width 22 in., and the length from 50 in. to 62 in., depending upon the throat depth.

» «

Duro Junior Holder Weighs Only Nine Ounces

★ Weighing only nine ounces, the new Duro Junior holder for metallic arc welding is designed for light precision work and can handle currents up to 200 amp. It is ruggedly constructed and includes the important features which are standard on the larger sizes of Duro holders. All parts are easily renewable. The Duro holder may be supplied with soldered or solderless type connection.

The plain Duro Junior holder has an insulated handle and trigger lever. The completely insulated Duro Junior holder is entirely protected from accidental arcing. The jaws and entire trigger are insulated with a special heat-resisting material in the form of shields. For prices and further information write to Churchward Engineering Co., Inc., 33 Sperry St., New Haven, Conn.



Duro Junior holder weighs but 9 oz.

» «

New Multi-Flame Tips for Lindewelding Pipe Lines

★ The Linde Air Products Co., Unit of Union Carbide and Carbon Corp., announces two new multi-flame welding tips for pipe-line construction by the Lindeweld process. The introduction of these two new multi-flame welding tips has resulted in increased speeds of 25 per cent or more and a corresponding reduction in gas consumption.

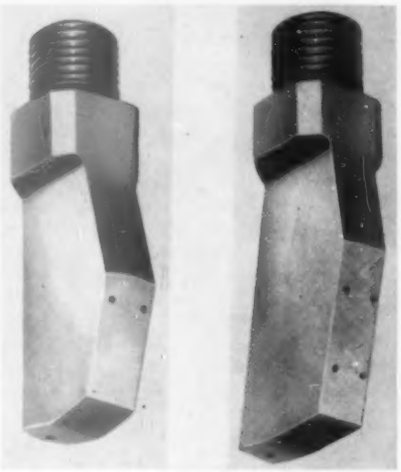


Fig. 1—(Left) 4-flame tip for position welds.
Fig. 2—(Right) 6-flame tip for rolling welds.

The four-flame tip (Fig. 1) has been designed for position welds while the six-flame tip (Fig. 2) is intended primarily for rolling welds. The four-flame tip provides, in addition to the main welding flame, two flames for preheating the vee and a fourth flame for preheating the welding rod. The six-flame tip is similar to the four-flame tip in design, with the exception that it has two additional vee preheat flames, so that four flames preheat the walls of the pipe, a fifth flame preheats the welding rod, and a sixth flame does the actual welding.

» «

CONSOLIDATED STEEL CORP., Los Angeles, was recently awarded a welding contract for the fabrication of 43 ring-seal gates each 102 in. in diameter. Forty of these ring-seal gates are for use at the Grand Coulee Dam, in Washington, and three are for power penstocks at the Seminole Dam, in Wyoming. These contracts represent an expenditure of approximately $1,089,000.

News of the Industry

NATIONAL METAL EXPOSITION IN DETROIT FORECASTS UPSWING IN INDUSTRIAL ACTIVITY

Still another indication of industry's optimism for Fall business came with the recent announcement that the 20th annual National Metal Exposition to be held in Detroit, Mich., October 17-21, will outstrip last year's record-breaking show both in size and scope. "More than 230 exhibitors, ranging from the steel and non-ferrous metal manufacturers to makers of furnaces, welding equipment and lock washers, have already arranged to show to industrial buyers in Detroit," said W. H. Eisenman, managing director of the Exposition.

"The country's heaviest industry, steel, is looking forward to a further upswing this Fall, judged by its plans for the Exposition," Mr. Eisenman continued. "Many steel manufacturers will exhibit for the first time, and practically all of the previous steel exhibitors will be in again. This same optimism is apparent in the size and scope of exhibits planned by alloy casting and furnace manufacturers and by other related industries."

This Exposition, one of the oldest industrial shows in the country, is staged annually in conjunction with the National Metal Congress. The event, attracting an audience of some 20,000 men, is sponsored by the American Society for Metals in cooperation with the American Welding Society, the American Institute of Mining and Metallurgical Engineers, and the Wire Association. Of unusual interest this year will be the visit of some 200 members of the Iron and Steel Institute and the Institute of Metals of Great Britain.

Three of these national societies have their annual conventions during the week of the Congress and Exposition, and more than a hundred engineering papers and discussions are delivered by authorities on every important metal development.

Personals

M. B. GATHMAN, director of the central development and experimental department of Fisher Body Co., and J. B. TEBBIN, of the P. R. Mallory Co., representing the automotive industry, attended a meeting of the Resistance Welding Committee of the Engineering Foundation Welding Research Committee held at Atlantic City, N. J., June 28-30. At this meeting they outlined a complete program for carrying on research in resistance welding from now until October. In October another meeting will be held in Detroit at the time of the annual meeting of the American Welding Society.

» «

WALTER WILLIAMSON, manager of apparatus and supply sales, has been elected vice-president of the WESTINGHOUSE ELECTRIC SUPPLY Co. Mr. Williamson will carry the responsibility for the development of the company's apparatus and supply business, both as to operations, through the company's 72 branch houses in the field and relationships with suppliers.

» «

WILLIAM C. SIMPSON has been appointed manager of sales for the newly-opened sales office of the Lukens Steel Co. in the Gulf Building, Pittsburgh, Pa. Mr. Simpson was born in Columbia, N. J., and after graduating from Belvidere, N. J., high school, attended

William C. Simpson

Blair Academy and Lehigh University. He graduated from Lehigh in 1932, with the degree of bachelor of science in metallurgical engineering.

Early in 1933, Mr. Simpson joined Bethlehem Steel Co. at Sparrows Point, Md., leaving to join the Lukens organization in January, 1934. He served at Lukens as research engineer in the metallurgical department, research metallurgist in the research department, and since September, 1936, in sales and sales development until his recent appointment as manager of sales of the Pittsburgh office.

» «

JAMES SUTTIE has been appointed general manager of the industrial division of American Steel Foundries effective August 1. Mr. Suttie will be in charge of sales and production.

» «

E. W. P. SMITH, consulting engineer, Lincoln Electric Co., Cleveland, Ohio, will conduct a series of welding lectures and demonstrations for the benefit of welding users in the Michigan City, Ind., and LaPorte, Ind., area, during the week commencing September 12th. Mr. Smith will be available for technical consultation during the daily demonstrations and will conduct lectures each evening during the week. His lectures will be supplemented with lantern slides.

During the week commencing September 19th, Mr. Smith will conduct a similar series of welding lectures and demonstrations in East Chicago, Ind. For further information regarding these meetings in Michigan City and East Chicago, the reader should get in touch with G. E. Tenney, manager, Lincoln Electric Co., 1455 West 37th St., Chicago.

» «

UNION DRAWN STEEL DIVISION of Republic Steel Corp., Cleveland, Ohio, announces two executive changes at its Massillon, Ohio, plant. THOMAS WEISKOPF, formerly assistant superintendent, is appointed superintendent and FRANK A. GARVEY is named assistant superintendent.

A.W.S. Activities

DETROIT SECTION, A.W.S. — At the July meeting the following officers were elected to serve for Detroit Chapter: DON COREY, The Detroit Edison Co., chairman; H. P. DOUD, General Electric Co., vice chairman; E. J. ROUSSEAU, Commerce Pattern, Foundry & Machine Co., secretary-treasurer.

Detroit section has made real progress during the past year under the leadership of VAUGHAN REID. Membership has been doubled over that of the previous year. According to J. B. TEBBIN, plans are already under way to make the coming year the biggest in the history of the Society.

The Automotive Advisory Council of the American Welding Society, of which C. L. EKSERGIAN, chief engineer of Budd Mfg. Co., is chairman, is taking an active interest in the plans for the convention to be held here in October.

» «

NEW YORK SECTION INSPECTION TRIP

An interesting inspection trip has been planned for members of the New York section, A.W.S., for the latter part of August. A new all-welded building containing 500 tons of structural steel, will be inspected. The date of trip and details may be obtained from CHARLES KANDEL, Craftsweld Equipment Co., Long Island City, who is in charge of arrangements:

Officers of the New York section, A.W.S., for the 1938-1939 term are as follows:

Chairman: J. L. WILSON, American Bureau of Shipping.

1st Vice-Chairman: CHARLES KANDEL, Craftsweld Equipment Co.

2nd Vice-Chairman: J. T. PHILLIPS, Foster-Wheeler Corp.

Secretary-Treasurer: G. V. SLOTTMAN, Air Reduction Sales Co.

» «

CHICAGO SECTION, A.W.S.—At its last meeting of the 1937-38 season, held May 20th, the Section elected the following officers and directors to serve for the 1938-39 season:

Chairman—R. E. MCFARLAND

Vice-Chairman—E. A. BALSLEY
Secretary-Treasurer—M. S. HENDRICKS
DIRECTORS FOR THREE YEARS:
C. J. ENLIND, The Globe Co.
OTTO CARLSON, Crane Co.
W. C. PEARSON, Westinghouse Elec. & Mfg. Co.
J. J. LEE, Compressed Industrial Gases, Inc.
Director to Represent Chicago Section at Annual Meetings:
C. J. MCGREGOR, American Steel & Wire Co.
The following directors continue in office until the expiration of their present terms:
TERMS EXPIRE IN ONE YEAR:
J. KINSOCK, Standard Oil Co. of Indiana.
LESLIE MCPHEE, Whiting Corp.
G. E. TENNEY, Lincoln Electric Co.
D. C. WRIGHT, Sears, Roebuck & Co.
TERMS EXPIRE IN TWO YEARS:
FRANK H. CARPENTER, Federal Pipe & Supply Co.
I. J. EALES, Steel Sales Corp.
ROBERT MALCOLM, Chicago Eye Shield Co.
O. L. HOWLAND, Hollup Corp.

Future Meetings

September 19-22, 1938

Track Supply Association, 57 East Van Buren St., Chicago. Exhibits held in conjuction with annual meeting of Roadmaster's and Maintenance of Way Association, Stevens Hotel, Chicago.

September 27-28, 1938

Master Boiler Maker's Association will hold its annual meeting at Hotel Sherman, Chicago.

September 27-30, 1938

Association of Iron and Steel Engineers, Empire Building, Pittsburgh, Pa.
Annual convention and Iron and Steel Exposition in the Cleveland Public Auditorium, Cleveland, Ohio.

October 5-7, 1938

American Society of Mechanical Engineers, 29 W. 39th St., New York City.
Fall meeting at Providence, R. I.

October 10-14, 1938

American Institute of Steel Construction, Inc., 200 Madison Ave., New York City.
Annual meeting at French Lick Springs, Ind.

October 17-21, 1938

National Metals Congress and Exposition, held in conjunction with American Welding Society, American Society for Metals, American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, and The Wire Association. American Welding Society headuartqers will be at the Book-Cadillac Hotel, Detroit, Mich.

October 24-27, 1938

American Mining Congress (Western Division)—Fifth Annual Metal Mining Convention and Exposition at the Ambassador Hotel, Los Angeles, Calif.

November 14-18, 1938

American Petroleum Institute, 50 W. 50th St., New York City.
Nineteenth annual meeting at the Stevens Hotel, Chicago, Ill.

November 28-30, 1938

American Institute of Electrical Engineers, 33 W. 39th St., New York City.
Southern District meeting at Miami, Fla.

December 5-9, 1938

American Society of Mechanical Engineers, 29 W. 39th St., New York City.
Annual meeting in New York City.

December 5-10, 1938

National Exposition of Power and Mechanical Engineering will be held at Grand Central Palace, New York City.

Trade News

SALES BILLED BY GENERAL ELECTRIC Co. during the first six months of 1938 amounted to $130,910,638, compared with $171,076,645 during the corresponding period of 1937, a decrease of 23%. Profit available for dividends for the first six months this year amounted to $13,176,956, compared with $26,293,604 for the first six months last year, a decrease of 50%.

» «

JOHNSON WELDING Co. has been formed in Detroit, Mich., to do all kinds of industrial welding. ELMER J. JOHNSON, an experienced man in the welding business, is head of the company. Shop and office is at 4523 Townsend Ave.

» «

SMITH-HAMBURG-SCOTT WELDING Co. has been reorganized as the PIERCE-WAY WELDING Co. The officers of the new company are: PAUL RIVAS, president; ROSSEL MILLER, vice president, and MAURO GARCIA, secretary-treasurer. The new company has taken over the plant of the former company at 4834 John R. St., Detroit, Mich. This is a two-story brick building, 30 ft. x 50 ft. Some remodeling has been done and new equipment added. The company is now equipped to do all kinds of commercial and industrial welding.

» «

FIFTEEN YEARS OLD—August of this year marks the fifteenth business year for the Sellstrom Mfg. Co., Chicago, which during this period has become widely known for its industrial eye-protectors. G. E. SELLSTROM, founder and president, ascribes the company's steady progress through an unfavorable economic period, to the fact that great care has been exercised in details that reduce weight of equipment and make it easy to fit the eyes and head with comfortable apparatus.

» «

STEEL FOUNDERS' SOCIETY OF AMERICA, Cleveland, Ohio, announces that on or about October 1, 1938, C. W. BRIGGS, physical metallurgist, Naval Research Laboratory, Washington, D. C., will join the Society's staff in the capacity of technical engineer. Mr. Briggs is a graduate of Standford University. Since taking his degree in metallurgy he has devoted most of his time to research work for the U. S. Navy, being at present the directing head of the steel casting research department.

» «

THE LONG BEACH WELDERS SUPPLY Co., of 1282 West Anaheim St., Long Beach, Calif., is enlarging its space to afford needed additional room for the welding accessories and supplies handled by the concern. The local agency for the Wilson line of arc welding equipment was recently placed with this firm. MALTON A. TEETER is proprietor.

» «

PAWTUCKETT MFG. Co., Pawtucket, R. I., announces that in addition to its regular line of steel and brass bolts and nuts it now carries in stock a full line of standard sizes of

Ryerson a dependable source for Welding Rod

• Ryerson Engineers have developed a series of rods that are outstanding for Quality production. More than twenty types, including both electric and gas rods, are carried in stock. Whether you need a shielded arc type for production work or a stainless steel rod you can be sure of immediate shipment... *Write for Bulletin which gives complete data.*

ELECTRODES

Ryerson Shielded Arc Type No. 215
Shielded Arc Type No. 216
Shielded Arc Type No. 217
Green Processed No. 18
Copper Coated No. 206
Copper Coated No. 210
Cast Iron

Ryerson Green Processed No. 6
Bare Mild Steel
Brown Processed White Flux Coated
High Carbon White Flux Coated
Blue Flux Coated

GAS RODS

3½% Nickel Steel
High Carbon Bare No. 2110

Ryerson 3½% Nickel Steel Flux Coated
High Manganese Steel Hard Surfacing
Allegheny Stainless Flux Coated
Allegheny Stainless No. 44

Tobin Bronze
Allegheny Stainless Bare Hard Filler

JOSEPH T. RYERSON & SON, Inc., Chicago, Milwaukee, St. Louis, Detroit, Cleveland, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City

Herculoy bolts and nuts and has issued a price list covering these items. Many special items are also quickly available. Herculoy is a silicon-copper alloy manufactured by Revere Copper and Brass, Inc., 230 Park Ave., New York, N. Y.

Pawtucket Mfg. Co. will send an illustrated bulletin explaining the characteristics of Herculoy along with a price sheet upon request.

» «

Dravo-Doyle Co., Pittsburgh, Pa., will represent The McKay Co., Pittsburgh, as distributor for the complete McKay line of arc-welding electrodes. The Dravo-Doyle territory will cover the "Tri-State" area, including Western Pennsylvania, Eastern Ohio and all of West Virginia.

Construction

The National Electric Welding Corp. of Huntington Park, Calif., recently began work on their contract for welding the steel frame of the new Southern California Telephone Co. building in Glendale. The structure will be four stories high with an estimated total of 3,000 ft. of welding. Reference to the designing of this building was made in the paper of Paul Jeffers, consulting engineer, presented at the recent Western Regional Conference, in Los Angeles. The Robertson Co., of Los Angeles, is general contractor in charge of this job.

» «

The Atlantic Refining Co. will increase the storage capacity of its water terminals at Newark, N. J., New Haven, Conn., and Kettle Point (Providence), R. I. Docking facilities at Newark will also be enlarged. Two new all-welded steel storage tanks with a capacity of 1,120,000 gallons each will be erected at Newark. One new tank with a capacity of 750,000 gallons will be erected at New Haven, and one new tank with a capacity of 725,000 gallons at Kettle Point. Construction at all three terminals was started early in June. The contract for the tanks has been awarded to Chicago Bridge and Iron Co. Total cost of increased storage and docking facilities will be in the neighborhood of $270,000.

» «

Robinson Welding Supply Co. and Bailey Steel Shipbuilding Co., both of Detroit, Mich., are engaged in the construction of three cabin cruisers. All of the welding equipment has been furnished by the Robinson Co. The cruisers are of all-welded construction throughout. Each is about 36 ft. long, and completely equipped will cost over $8,000 each. Mr. Robinson states that this is expected to be the start of all-welded pleasure craft construction and will replace the wooden construction used in the past.

» «

The Southern Pipe Line Co., of Corpus Christi, Texas, will soon begin work on a 10-mile welded 6⅝-in. oil line to extend from the Turkey Creek oil field to Corpus Christi.

» «

Welded pipe lines under construction in the Texas oil fields at the present time: A 35-mile gas line from Crane to Judkins, by the Phillips Petroleum Co.; a 12-mile oil line from the Rotan field to Hawley Station, by the Fisher County Pipe Line Co.; and reconditioning a 91-mile section of 8-in. line of the Magnolia Pipe Line Co., which was laid in 1911 from Electra to Beaumont via Corsicana. Reconditioning of this line will consist of cutting out the old threaded joints and welding the new line completely.

» «

The San Joaquin Valley Light & Power Corp., of Fresno, Calif., has started construction on a 14-mile welded natural gas line from Merced to Atwater, Calif. Crane Co. has been awarded the contract for this project.

» «

The Texas Pipe Line Co. is planning construction of a 250-mile welded oil pipeline to extend from the Lake Barre and Caillo Island fields in Louisiana, to its refinery at Port Arthur. Cost of the line is estimated at $2,500,000.

» «

The Continental Oil Co. announces a welding program for the near future to include an 80-mile welded gathering pipeline, together with the construction of three casing-head gasoline plants. This work will be in Wichita County, Texas, and will be under way in the near future. Continental will also lay a 245-mile 6-in. welded oil line in the near future from the Lance Creek oil field, of Wyoming, to Denver, Colo. This latter project will cost about $2,000,000.

» «

The Oklahoma Pipe Line Co., of Tulsa, Okla., has approved plans for the laying of a 21-mile welded 8-in. oil pipeline to extend from Springer, Okla., to Sulphur. Booster stations also employing a great amount of welding will be installed, bringing the cost of the project to near $150,000.

» «

Consolidated Gold Mines Co., Ltd., will make extensive use of welding in the construction of its new ore mill at Das Cabezos, Ariz.

» «

The Mexican Eagle Oil Co., of Tampico, Mexico, plans the early construction of a 20-mile welded crude oil transportation line, to extend from the Tampico oil field to Pazarica. The cost of the project will aggregate about 4,000,000 pesos, or approximately $1,120,000.

» «

The Continental Oil Co. has started work on a 35-mile welded 6-in. oil line, to extend from Cilleplatt to Tepetate, in Evangeline Parish, Southern Louisiana.

The Improved "Round File" Gas Lighter

The "Round File" construction provides a very large file area — *approximately one square inch.* This assures longer life for the lighter. The file is of superior quality and can be easily replaced.

Many superior design and construction features combine to make the Improved "Round File" the most economical and efficient lighter on the market. Get acquainted with Improved "Round File" and its many advantages.

Circular and prices on request.

SAFETY GAS LIGHTER CO. (Est. 1901) **LYNN, MASS.**

Foreign News

Largest Welded Everdur Alloy Tank

A large all-welded tank, claimed to be the largest yet constructed from copper-manganese-silicon alloy, or "Everdur," was recently completed by the firm of Alexander McAra, Dundee, Scotland, for a large steam laundry.

This tank, of 1,500 gal. capacity, was designed for hot water storage and one of the requirements was stated to be "a hot water supply which can be guaranteed free from rust and corrosion products." Everdur metal was chosen because it combines the corrosion resistance of copper with the strength of steel.

Four hot-rolled sheets of the alloy, 11 ft. by 4 ft. (9 gauge) and two circles of the same material, 5 ft. 7 in. in diameter (7 gauge), were used in the construction of the tank, which is 12 ft. long and 5 ft. in diam-

eter. It was tested under a pressure of 45 psi. The material was used in lighter gauges than could have been specified for steel, no allowances having to be made for reduction of thickness due to corrosion in service.

The vessel was oxy-acetylene welded throughout, using 28 lb. of Everdur (6 gauge) welding rod. A feature of this alloy is its ease of welding by any of the standard methods. Strengths of the welds were fully confirmed by tests on two sample welds. These specimens, made from plates similar to those used in the construction of the tank and finished by cold hammering in the same way as the seams, showed tensile strengths of 26 and 26.1 tons per square inch, and elongation in 2 inches of 37 and 36% respectively. The fracture in each case occurred in the parent metal and not in the weld, indicating that the strength of the joint was fully equal to that of the parent metal.

» «

WELDING STEEL AND CAST IRON

While both steel and cast iron are ferrous metals, the difference in carbon content between them has in the past made it difficult to weld them together with adequate strength and density in the weld. A welding process that would overcome these difficulties would possess the great advantage of combining the strength of steel with the rigidity of cast iron. Moreover, if an outer shell, such as the water jacket of cylinders, can be made of steel instead of cast iron, the main casting is simplified and cheaper to produce. There is also a saving in weight.

Recognizing the need, a London welding concern (Barimar, Ltd.) has devised and is now operating a new process for welding together steel and cast iron, the work being done by means of a special steel rod which, it is claimed, assures thorough amalgamation of the two metals.

Current Reviews

BIBLIOGRAPHY ON INDUSTRIAL RADIOGRAPHY —Herbert R. Isenburger of St. John X-Ray Service, Inc., 30 Thomson Ave., Long Island City, N. Y., has completed his bibliography on Industrial Radiography which is a supplement to his book on the same subject, published in 1934 by John Wiley & Sons, Inc., New York City.

The new bibliography comprises 776 references on 52 pages. It may be obtained from American Documentation Institute, 2101 Constitution Ave., Washington, D. C., ordering Doc. 1139, remitting 72 cents for copy in microfilm (35 mm. standard safety photographic film, for use in reading machines). If preferred, an original transcript can be had in 8½ by 11 in. black and white prints for $3.32.

» «

"A STORY OF FAITH THAT LED TO FORTUNE" —This is the title of an interesting twenty-page booklet reviewing the successful career of R. G. (Bob) LeTourneau, manufacturer of welded earth moving equipment. This biographical sketch traces Bob LeTourneau's career from the age of fourteen when he quit eighth grade to get a job in a foundry, up to the period of his present successful business, which passed the five million dollar mark in 1937.

Quoting from the booklet: "With Bob LeTourneau, welding is a thinking tool as well as a manufacturing and construction tool. It simplifies invention. It gives him engineering freedom to devise new and valuable design ideas that vastly improve existing practices. It enables him to find the answers to problems that stump too many men in his position and with his responsibilities. With him, welding is an irresistible faith responsible for his progress and profit."

We learn further in this interesting review of the R. G. LeTourneau Co., Peoria, Ill., that Bob LeTourneau never encountered a problem that he could not solve by welding. "Many designers are handicapped," says Mr. LeTourneau, "because they have always thought in terms of castings. When they redesign to get the greater strength and uniformity of rolled steel, they try to convert the old casting into a welded design. The most effective approach is to forget all about former methods. Think about the function of the machine or the part to be designed and use welded steel to produce the results. Whether he realizes it or not, the average man is governed by the dictation of years of habit. To be successful with welding, he should think in terms of welding, and

For sound OVERHEAD welds use

TITAN MANGANESE BRONZE RODS

(Trade Mark Registered)

TITAN Manganese Bronze Welding Rods flow freely, readily penetrate seams and crevices and provide extremely dense, non-porous welds. Overhead welds made with **TITAN Manganese Bronze** will "stay put."

TITAN Manganese Bronze is widely used because of its ability to lay down strong, tough welds in any position. There is no fuming to bother the operator or cause poor welds, because the exclusive **TITAN** Double Deoxidation process prevents gases from being absorbed from torch, atmosphere or base metal.

Another **TITAN** Doubly-Deoxidized Alloy preferred by experienced welders is **Penn Bronze**—a general purpose, free-flowing rod, melting at 1620° F.

Samples of these TITAN Doubly-Deoxidized Welding Alloys gladly sent on request. Test them and prove that they produce welds of definitely greater strength and ductility.

TITAN METAL MANUFACTURING CO. • Bellefonte, Pa.

TITAN BRONZE WELDING ALLOYS

follow the rules of welding just as the casting man thinks in terms of casting and follows the rules of casting. The methods (and the results) of the one are in no way related to the other."

Mr. LeTourneau says further: "To exploit successfully the far-reaching advantages of welded steel construction, the manufacturer should have in his organization a man of authority with a zest for using welding. With such a man in the organization progress will be rapid as the fundamentals of welded design and production procedure are mastered."

Any reader who desires can obtain a copy of this 20-page bulletin by addressing a request to the Lincoln Electric Co., Cleveland, Ohio.

Recent Patents

Electric Arc Welding

2,121,693. Hugh M. Henderson, Scunthorpe, England. Filed March 31, 1936. A method of electric welding is covered in this patent, which protects the arc and the weld pool from the effects of the nitrogen and oxygen of the surrounding air. An automatic feed is provided for the welding rod. The rod passes freely through a thick walled rigid tube which is linearly consumable at its end adjacent to the work. The tube is composed mainly of non-metallic material, such as carbon or carbon with fluxing material. Fluxing material may be used without the carbon. The method also contemplates feeding a gas or a flux powder to the work by passing the gas or powder toward the work between the tube and the rod.

Welding Flux

2,121,770. Cecil G. Chadwick, West New York, N. J., assigned to Union Carbide and Carbon Corp., New York. Filed Aug. 1, 1934. A flux for use in welding steels containing more than 2% chromium, to produce welds substantially free from non-metallic inclusions and soluble carbides. The flux comprises a substantial proportion of columbium in the metallic state, silicon, and a slag-forming substance of feldspar and calcium carbonate. The columbium forms about 10 to 40% of the flux.

» «

Method of Welding Lead and Lead Alloys

2,122,185. Albert A. Smith, Jr., Metuchen, N. J., assigned to American Smelting and Refining Co., New York. Filed March 20, 1937. Heretofore there have been difficulties in welding articles or surfaces of lead and lead alloys. This problem is met with in uniting grids to terminals in storage battery manufacture. The patentee provides a flux containing sodium acetate. The flux melts just below the melting point of lead. Accordingly, when the flux is associated with a welding rod, either as a coating on the rod or a core in the rod, the flux flows readily as the rod melts. The use of this flux gives a strong joint.

» «

Automatic Welding Torch

2,122,194. Butler L. Bixby, Buffalo, N. Y., assigned in part to Edward H. Wright, Olean, N. Y. Filed June 25, 1937. This welding torch has automatic means to feed the welding rod in a predetermined path to the apex of the flame. An adjustable speed control permits variation in the rate at which the rod is fed. The use of the torch facilitates the work of welding as well as producing a smooth and uniform application of metal. Customary grinding and buffing is alleged to be unnecessary when this torch is employed.

» «

Lead Welding

2,123,455. Upton B. Thomas, Jr., New Providence, N. J., assigned to Bell Telephone Laboratories, Inc., New York. Filed May 20, 1936. Another approach to the welding of lead articles is given in this patent. While the Smith patent, 2,122,185, discussed above uses sodium acetate, the present patentee employs a solution of acetic acid. The method consists in heating the parts to be welded to a temperature at which an objectionable amount of lead oxide is formed, and then by applying a water solution of acetic acid, converting the oxide into lead acetate. Continued heating volatilizes the lead acetate and the required temperature is attained for completing the welding of the parts.

» «

Welding Electrode

2,123,628. Franz R. Hensel and Earl I. Larsen, Indianapolis, Ind., assigned to P. R. Mallory & Co., Indianapolis, Ind. Filed June 12, 1936. A resistance welding electrode composed of .05 to 10% manganese, .05 to 5% phosphorus, and the remainder copper. This electrode is characterized by a high strength and hardness, and good electric and heat conductivity.

» «

Electrode Alloy

2,123,629. Franz R. Hensel and Earl I. Larsen, Indianapolis, Ind., assigned to P. R. Mallory & Co., Indianapolis, Ind. Filed July 16, 1936. A special alloy is described for use in pressure exerting welding electrodes such as spot welding electrodes. The alloy contains .05% to 5% cobalt, .01% to 2% phosphorus, and the remainder copper. The alloy has a high hardness and electrical conductivity. This prevents mushrooming in service. The electrodes are well adapted for the welding of terne or tin-plate.

» «

Electric Welding Electrode

2,123,571. Wolfgang Lessel, Berlin-Charlottenburg, Germany. Filed Jan. 25, 1937. Ordinarily it is difficult to employ electrodes of copper for welding. This is due to the high heat conductivity of the copper, and the heat supplied to the welding area by the arc is too rapidly led away into the work. Thus at the welding zone the heating is insufficient. Attempts to overcome this difficulty have been made by preheating the welding zone. While such practice is satisfactory when bronze is used it is not suitable for copper. Moreover, preheating often has undesirable effects. The inventor of this patent provides a sheathing of non-conducting materials around the welding rod. The melting point of the sheath is such that the non-conducting material melts off subsequent to the melting of the metal rod, the melting of the sheathing being sufficiently retarded so that during the welding a tube of sheathing material projects beyond the end of the metal rod a distance of not more than six times the diameter of the metal rod. An arc 10 to 40 millimeters long is

DOUBLE WILLSON PLANT CAPACITY DOUBLED

68 YEARS OF SAFETY SERVICE TO INDUSTRY

To Meet

PRODUCTION DEMANDS

In order to provide greater production facilities for Goggles, Respirators and Welding Protective Devices, we have just doubled the size of our factory at a cost of more than $500,000.

We thank those good friends and users of our products who have made this plant expansion program possible, and pledge a continuation of the high quality materials and workmanship backed by progressive research which have made WILLSON PRODUCTS favorably known throughout the world.

Willson Offers Welders a Complete Line of Protective Devices
Catalogue on Request

DOUBLE WILLSON
PRODUCTS INCORPORATED
READING PENNSYLVANIA

INDUSTRIAL SAFETY EQUIPMENT ASSOCIATION

GOGGLES
RESPIRATORS
HELMETS

used as compared to short arcs or 2 to 5 millimeters used heretofore. A high tension current is required to produce the arc. The sheathing is composed of 50 parts of boric acid, 35 parts sodium phosphate, 6 parts of salt, 6 parts of cryolite, and 3 parts glass. The use of such a sheathing avoids the influence of air on the drops of welding metal, and also prevents splashing of the drops.

Trade Literature

"FCC Products and Services" is the title of a colorful 64-page catalog just issued by The Forging and Casting Corp., Ferndale (Detroit), Mich. The book contains detailed illustrations and descriptions of FCC special products, including forgings, composite steel die sections, nitri-cast-iron, cast-to-shape tool steel, and the like. Also, there are handy tables of weights, analyses, decimal equivalents, and other useful reference material.

» «

Thermit Welding—A new 34-page booklet describing the thermit welding process and its applications is announced by the Metal & Thermit Corp., 120 Broadway, New York City. Far more complete than anything published previously on the subject, the new booklet gives the history of thermit welding; describes the nature of the thermit reaction, by means of which superheated liquid steel is produced for welding purposes; discusses the physical properties of thermit weld metal; outlines the methods employed in welding. In addition, the advantages and economies of the process, for emergency repairs in the marine field; for repairs throughout industry to machine frames, crankshafts and other heavy parts; for reclamation work in steel mills; and for rail welding on steam railroad, street railway and coal mine track, are thoroughly covered. Also, several pages are devoted to thermit for foundry use, and to the pure, carbide-free metals and alloys produced by the thermit reaction and used for alloying purposes in the manufacture of steel and non-ferrous alloys.

» «

Metal & Thermit Corp., 120 Broadway, New York City, announces a new edition of its handy, pocket-size pamphlet on Murex welding electrodes. Considerably revised and enlarged, the new issue contains brief data on the physical properties and chemical analysis of the weld metal deposited by each of the twenty odd electrodes in the Murex line. Included are individual, specially designed electrodes for high speed, downhand welding of mild steel; for all-position welding; for horizontal fillet work; for welding manganese, carbon-molybdenum and nickel steels; for several types of stainless steels; and, for a number of the new high-strength, low-alloy steels.

» «

Mine Safety Appliance Co., Pittsburgh, Pa., has just issued a new informative bulletin describing their specially designed bulletin boards for safety and general bulletins. These bulletin boards are used extensively by both large and small companies for supplementing safety and educational programs. They are sturdily built of 24-gauge steel, finished in green enamel and are available in either single, or double-board types.

Copies of this bulletin may be obtained by writing to the manufacturer direct.

» «

Stulz-Sickles Co., 134 Lafayette St., Newark, N. J., has issued circulars covering stock sizes and prices on hot rolled Manganal plates. Stock sizes range from $\frac{3}{8}$ to $\frac{1}{2}$ in. thickness, in widths up to 48 in. and lengths up to 120 in. Manganal plates are used in fabricating parts of welded structures which are subjected to severe impact and abrasion.

Stulz-Sickles Co., 134 Lafayette St., Newark, N. J., announces the appointment of the following distributors for Manganal plates: Richard E. Ela Co., 921 E. Washington Ave., Madison, Wis. Welders Service Co., 3620 Detroit Ave., Toledo, Ohio.

» «

Hobart Multi-Range Arc Welder—This is the title of a well illustrated 24-page catalog just issued by Hobart Brothers, Troy, Ohio. The new booklet features Hobart Multi-Range Dual-Control arc welders, emphasizing such operating advantages as remote control, polarity control, and two-way improved ventilation. The illustrations of constructional details are exceptionally clear.

Cut WELDING COSTS With a MARQUETTE A.C. ARC WELDER

OPERATING COST

A. C. Arc Welding is the cheapest method of welding metals.

ORIGINAL COST

Moderately priced at $155, $195 and $225 . . . all models fully equipped.

TERMS

Jobbers offer the new MARQUETTE on a liberal time payment plan.

- Three models at three prices . . . a size and price to fit your needs.
- Oversize transformer for reserve power and steady even arc at all 15 heat stages.
- A tap for every heat, a heat stage for every job . . . no dials, no combinations, no confusion.
- Ample ventilation through bottom screen and louvered top.
- Every model fully equipped . . . nothing extra to buy.

If you are now doing welding with an old machine, you can cut your costs with a new MARQUETTE . . . If you are planning to buy a new machine, be sure to investigate the advantages of a MARQUETTE.

Ask Your Jobber Salesman for Full Details or Write Direct to

Marquette A. C. Arc Welders are listed by Underwriters' Laboratories, Inc., and carry their Reexamination Service Marker.

MARQUETTE MFG. CO., INC.
MINNEAPOLIS, MINNESOTA

NEW YORK WELDING SUPPLY CO., INC., 75 Grand St., New York City, has issued a loose-leaf catalog of welding supplies. This company handles American Agile electrodes, National Carbon Co. products, Westinghouse Flexarc welders and a full line of welding accessories.

» «

CUTTING TORCH BULLETIN—Victor Equipment Co., 844 Folsom St., San Francisco, Calif., has just issued a 24-page bulletin describing Victor cutting torches and their application. Subjects covered include fuel gases, oxidation of iron, torch cutting effects, speed of cutting, design of cutting torch tips, high pressure valves, hose connections, etc. How to select the proper cutting tip is clearly explained. The Victor (patented) spiral mixer is explained with the aid of a diagram. Repair instructions and technical data tables are included at the back of the book.

» «

LINCOLN ELECTRIC CO., Cleveland, Ohio, has issued a small folder describing the application of Lincoln "Spatter Film." The folder explains that weld cleaning time can be reduced 20 to 50 per cent with the application of "Spatter Film" before welding.

Classified Section

ADVERTISING RATES

Help Wanted — 75c per line, minimum 4 lines. Jobs Wanted — 4 lines free. Other Ads — $1.00 per line, minimum 4 lines. Count 8 words to line. Add 6 words for keyed address.

FOR SALE

BARGAINS—Demonstrator Arc Welders. Gasoline and electric drive. 30 days' trial. Easy terms if desired. Write Hobart Welder Exchange, Box U-881, Troy, Ohio.

FOR SALE—Complete low-priced welding and cutting outfits. Guaranteed. Soldering and brazing torches. Dependable repair service on all makes of equipment. Gasweld Equipment Co., 625 W. Jackson Blvd., Chicago, Ill.

FOR SALE—Acetylene Welding Outfits, $32.95 to $64.95; Portable Acetylene Generators, $59.90 to $69.90; Electric A-C. Arc Welders, $99.45 to $175.00. Easy-Payment Plan. Superior Oxy-Acetylene Machine Co., Hamilton, Ohio.

FOR SALE—Welding and Radiator Shop. 2 elec. machines, 4 oxy-acetylene outfits, new truck, three-man shop. Est. 15 years. Most completely equipped shop in a radius of 50 miles. A business that has never known depression. Building and lot. C. M. Miller Co., 305 S. West St., Madison, Ind.

FOR SALE—Complete Mogul metallizing outfit, almost new. Includes Mogul gun, sand blast, compressor. Reason—changing type of business. Virginia Welding Co., 116 Virginia St., East, Charleston, W. Va.

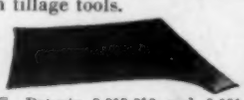
LEONARD ALLOY—A successful welding rod for repairing aluminum, white metal and die-cast pot metal. 3 Bars, $1.00; 9 Bars, $2.50 (Bars—2 oz.). Leonard Mfg. Co., Manlius, Ill.

FALL PLOWING WILL SOON BEGIN

Start Now to Make Your Profits

NEW! *Write for information on the new WIESE plow share reclaiming unit. New type of Drop Forged point and cutting edge.* **NEW!**

Send for new catalog showing units for plow shares, cultivator shovels, planter runners, sweeps, listers, and joiners. A complete line for farm tillage tools.

Electric  **Welded**

U. S. Patents 2,013,818 and 2,051,234
Canadian Patents 365,296 and 369,723

NEW PROCESS PLOW WELDING CO.

PERRY *Manufacturers of Cultivator Shovels and Sweeps* **IOWA**

WELDERS' TEMPLATES SAVE TIME ON PIPE FITTING—No longer necessary to stop pipe welding to do drafting. Make your own templates from master blue prints. Set consists of 20 blue prints covering over 200 pipe patterns. Complete set costs $15.00, cash or C.O.D. Postage prepaid. F. W. Bollman, Pennville (Jay County), Ind.

FOR SALE—Lincoln Welders 75, 100, 150, 200, 300, 400-amp. generators, electric, or engine-driven types. Bargains. Also Hansen, G-E, Westinghouse and Wilson. 20,000 ft. excess stock superflex cable, cheap. Address Aug-4, The Welding Engineer.

WANTED TO BUY

WANTED TO BUY—Prest-O-Lite A, B, E, and MC gas cylinders. Address Aug-1, The Welding Engineer.

HELP WANTED

WANTED—An experienced resistance welder, preferably a graduate engineer. Should have gas welding experience and knowledge of metallurgy of steel. State age, exp., and salary expected in first letter. Address Aug-2, The Welding Engineer.

POSITION WANTED

ARC WELDER—5 yrs. exp. Heavy construction and maintenance. Layout and set-up exper. from blue prints and A. W. S. symbols. Weld in all positions. Can pass Govt. inspection. Address Aug-5, The Welding Engineer.

WELDER AND MECHANIC—3 yrs. a-c. welding, 180 hours electric training in school, all positions. Age 25, single, willing go anywhere, U. S. or foreign. Willard J. Daugherty, La Motte, Iowa.

OXY-ACETYLENE & ARC WELDING—10 yrs. exp. light and heavy work. Blacksmith and repairing exp. Contractor or shop. Sober, steady, married, age 28. Rudolph Kring, Box 14, Farmingdale, S. D.

COMBINATION WELDER—10 yrs. exp. light and heavy work. Fast production. Also maintenance work in job shop. Age 32, married. George J. Pastove, 778 Burnham Ave., Calumet City, Ill. Phone Hammond 447.

ARC WELDER—Age 22—Welding school graduate. Want job as helper to gain experience. Free to go anywhere. Edward R. Nardin, 1739 N. Kedvale Ave., Chicago, Ill.

WELDING PROBLEMS—Young industrial engineering graduate. Four years machine shop, and three years welding design and steel fabrication exp. Can handle welding design, supervision of weldery, and sales engineering work. Address Aug-3, The Welding Engineer.